with Indexes

NASA SP-7011(328) October 1989

National Aeronautics and Space Administration

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 328)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1989 in

- · Scientific and Technical Aerospace Reports (STAR)
- International Aerospace Abstracts (IAA).

1989

This supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, price code A04.

INTRODUCTION

This Supplement to Aerospace Medicine and Biology lists 104 reports, articles and other documents announced during September 1989 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

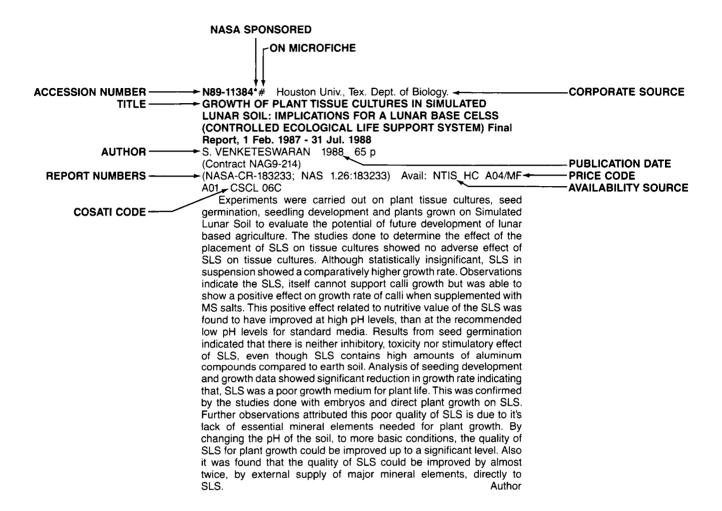
An annual index will be prepared at the end of the calendar year covering all documents listed in the 1989 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

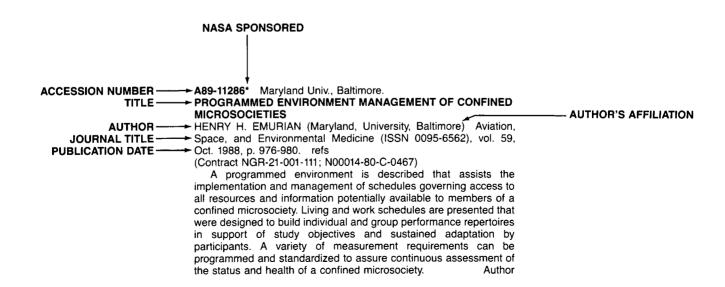
TABLE OF CONTENTS

	Page
Category 51 Life Sciences (General)	191
Category 52 Aerospace Medicine Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.	194
Category 53 Behavioral Sciences Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	200
Category 54 Man/System Technology and Life Support Includes human engineering; biotechnology; and space suits and protective clothing.	203
Category 55 Space Biology Includes exobiology; planetary biology; and extraterrestrial life.	207
Subject Index	A-1
Personal Author Index	
Corporate Source Index	
Foreign Technology Index	D-1
Contract Number Index	
Report Number Index	
Accession Number Index	G-1

TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 328)

OCTOBER 1989

51

LIFE SCIENCES (GENERAL)

A89-40118 STRUCTURE AND FUNCTION OF BACTERIAL PHOTOSYNTHETIC REACTION CENTRES

G. FEHER, J. P. ALLEN, M. Y. OKAMURA (California, University, La Jolla), and D. C. REES (California, University, Los Angeles) Nature (ISSN 0028-0836), vol. 339, May 11, 1989, p. 111-116. Research supported by NSF and NIH. refs

The recent determination of the crystal structures of the reaction centers of two photosynthetic bacteria is used here to investigate quantitatively the primary electron transfer processes of photosynthesis. The three-dimensional structure of the reaction centers and the electronic structure of the cofactors are described. The structure-electron transfer relationship is elucidated. C.D.

A89-40124 ORIGIN OF THE ALGAE

ROLAND PERASSO, ANNE BAROIN, ANDRE ADOUTTE (Paris XI, Universite, Orsay, France), LIANG HU QU, and JEAN PIERRE BACHELLERIE (Toulouse III, Universite, France) Nature (ISSN 0028-0836), vol. 339, May 11, 1989, p. 142-144. Research supported by CNRS, Universite de Paris XI, and Universite de Toulouse III. refs

Partial sequences of the large (28S) cytoplasmic ribosomal RNA from 10 new species of protists belonging to various groups of unicellular algae are analyzed. By combining them with the homologous sequences from 14 other unicellular and multicellular eukaryotes, it is shown that rhodophytes, chromophytes, and chlorophytes emerge as three distinct groups late among eukaryotes, that is, close to the metazoa-metaphytes radiation. This implies a relatively late occurrence of eukaryotic photosynthetic symbiosis. Details of intra- and interphyla relationships are provided.

A89-40125

PHYLOGENETIC ANALYSIS BASED ON RRNA SEQUENCES SUPPORTS THE ARCHAEBACTERIAL RATHER THAN THE EOCYTE TREE

MANOLO GOUY (Texas, University, Houston; Lyon I, Universite, Villeurbanne, France) and WEN-HSIUNG LI (Texas, University, Houston) Nature (ISSN 0028-0836), vol. 339, May 11, 1989, p. 145-147. Research supported by NIH. refs

A89-40877

RNA-PROTEIN INTERACTIONS IN 30S RIBOSOMAL SUBUNITS - FOLDING AND FUNCTION OF 16S RRNA

SETH STERN, TED POWERS, HARRY F. NOLLER (California, University, Santa Cruz), and LI-MING CHANGCHIEN (Wisconsin, University, Madison) Science (ISSN 0036-8075), vol. 244, May 19, 1989, p. 783-790. refs

(Contract NIH-GM-17129; NSF DMB-85-21802)

Chemical probing methods have been used to 'footprint' 16S ribosomal RNA (rRNA) at each step during the in vitro assembly

of twenty 30S subunit ribosomal proteins. These experiments yield information about the location of each protein relative to the structure of 16S rRNA and provide the basis for derivation of a detailed model for the three-dimensional folding of 16S rRNA. Several lines of evidence suggest that protein-dependent conformational changes in 16S rRNA play an important part in the cooperativity of ribosome assembly and in fine-tuning of the conformation and dynamics of 16S rRNA in the 30S subunit.

Author

A89-40924 HOW OLD IS THE GENETIC CODE? STATISTICAL GEOMETRY OF TRNA PROVIDES AN ANSWER

MANFRED EIGEN, BJOERN F. LINDEMANN, MANFRED TIETZE, RUTHILD WINKLER-OSWATITSCH (Max-Planck-Institut fuer Biophysikalische Chemie, Goettingen, Federal Republic of Germany), ANDREAS DRESS (Bielefeld, Universitaet, Federal Republic of Germany) et al. Science (ISSN 0036-8075), vol. 244, May 12, 1989, p. 673-679. refs

The age of the molecular organization of life as expressed in the genetic code can be estimated from experimental data. Comparative sequence analysis of transfer RNA by the method of statistical geometry in sequence space suggests that about one-third of the present transfer RNA sequence divergence was present at the urkingdom level about the time when archaebacteria separated from eubacteria. It is concluded that the genetic code is not older than, but almost as old s our planet. While this result may not be unexpected, it was not clear until now that interpretable data exist that permit inferences about such early stages of life as the establishment of the genetic code.

A89-40971

THE INTRINSIC ELECTROPHYSIOLOGICAL PROPERTIES OF MAMMALIAN NEURONS - INSIGHTS INTO CENTRAL NERVOUS SYSTEM FUNCTION

RODOLFO R. LLINAS (New York University, Medical Center, NY) Science (ISSN 0036-8075), vol. 242, Dec. 23, 1988, p. 1654-1664. refs

This article reviews the electroresponsive properties of single neurons in the mammalian central nervous system (CNS). In some of these cells the ionic conductances responsible for their excitability also endow them with autorhythmic electrical oscillatory properties. Chemical or electrical synaptic contacts between these neurons often result in network oscillations. In such networks, autorhythmic neurons may act as true oscillators (as pacemakers) or as resonators (responding preferentially to certain firing frequencies). Oscillations and resonance in the CNS are proposed to have diverse functional roles, such as: (1) determining global functional states (for example, sleep-wakefulness or attention), (2) timing in motor coordination, and (3) specifying connectivity during development. Also, oscillation, especially in the thalamo-cortical circuits, may be related to certain neurological and psychiatric disorders. This review proposes that the autorhythmic electrical properties of central neurons and their connectivity form the basis for an intrinsic functional coordinate system that provides internal context to sensor input. Author

A89-41017 OXYGEN OZONE AFROSOLS AND ULTI

OXYGEN, OZONE, AEROSOLS AND ULTRAVIOLET EXTINCTION IN GEOLOGICAL TIMES

RASHMI PAUL, A. K. SAHA (National Physical Laboratory of India, New Delhi), and T. BANERJEE (Council of Scientific and Industrial Research, Publications and Information Directorate, New Delhi, India) Indian Journal of Radio and Space Physics (ISSN 0367-8393), vol. 16, Oct. 1987, p. 331-334. refs

An attempt is made at some quantitative estimation of solar ultraviolet extinction during geological times as combined absorbing (and scattering) effect of ozone and aerosols. Based on some atmospheric oxygen growth models, ozone levels are estimated, whereas aerosol levels are inferred from volcanic ash deposit records. It would appear that ultraviolet dosages at ground level should have generally remained below harmful limits throughout the geological period of the last 600 million years. Influence of biology and ecosystems may, however, have been possible with sudden decrease of ozone, caused by events like a supernova explosion, not too far away from the sun.

A89-41113

MAGNETOFOSSIL DISSOLUTION IN A PALAEOMAGNETICALLY UNSTABLE DEEP-SEA SEDIMENT

HOJATOLLAH VALI (Muenchen, Technische Universitaet, Munich, Federal Republic of Germany; California Institute of Technology, Pasadena) and JOSEPH KIRSCHVINK (California Institute of Technology, Pasadena) Nature (ISSN 0028-0836), vol. 339, May 18, 1989, p. 203-206. Research supported by NSF and DFG. refs

Results are presented from a high resolution TEM study of 'magnetofossil' bacterial magnetosome remains from clay-rich deep-sea sediments which, for unknown reasons, do not record a stable remanent magnetization. The material studied contains a complex mixture of single-domain magnetic minerals. Since it has been impossible to find authigenic magnetic minerals in the sample, and since the magnetic fraction is dominated by well-preserved magnetofossils, it is suggested that the poor preservation of the magnetization is a result of diagenetic interactions between the magnetofossils and the clay minerals in the matrix.

A89-41619

FREE-ELECTRON LASERS IN ULTRAVIOLET PHOTOBIOLOGY

THOMAS P. COOHILL (Western Kentucky University, Bowling Green, KY) and JOHN C. SUTHERLAND (Brookhaven National Laboratory, Upton, NY) Optical Society of America, Journal, B: Optical Physics (ISSN 0740-3224), vol. 6, May 1989, p. 1079-1082. Research supported by DOE. refs

The potential uses for a free-electron laser (FEL), tunable in wavelength from 10 to 400 nm, for photobiological experiments is discussed. Inherent problems of cell and molecular absorption, especially in certian regions of the ultraviolet (UV), are addressed. Absorption values for living cells and viruses at selected wavelengths in the UV are tabulated, and a calculation of the flux needed to inactivate mammalian cells is included. A comparison is made of the UV output of a proposed rf-linac FEL with those of a monochromator, a tunable dye laser, and a synchrotron. The advantages of a UV FEL are apparent, especially in the wavelength regions where the cross section for absorption by biological molecules is low, i.e., 300 to 400 nm and 10 to 200 nm. It is apparent that a UV FEL would be an ideal source for a variety of biological studies that use both intact organisms and isolated cells and viruses.

A89-41851

GO FORTH AND MULTIPLY?

LANCE FRAZER Ad Astra (ISSN 1041-102X), vol. 1, June 1989, p. 24-29.

The study of reproduction in space is reviewed. Microgravity experiments on amphibian and bird eggs are examined, including the chicken embryo experiment which was flown on the Space Shuttle in March, 1989. The effects of stress, radiation, and microgravity on human reproductive function are discussed. Plans for future studies to determine the effects of space on human reproduction are considered, including the development of the Lifesat program of free-flying satellites to perform life science experiments.

A89-41860

PROTEROZOIC MICROFOSSILS FROM MANGANESE OREBODY, INDIA

P. C. BANDOPADHYAY (Geological Survey of India, Calcutta) Nature (ISSN 0028-0836), vol. 339, June 1, 1989, p. 376-378. refs

The presence of microfossils from the Proterozoic manganese orebody of the Penganga Group, India, is reported. These microfossils occur commonly in chert and are present within manganese oxide sediments. The microfossils probably have affinities with the Cyanobacteria and may have been planktonic; both coccoid and filamentous forms are present. The presence of these microfossils suggest a possible genetic relationship between microbiota and manganese deposition and provides further information about Proterozoic ecology.

A89-42405

VARIATION OF CYTOPLASMIC RNA IN THE RAT'S MOTOR CORTEX NEURONS AND CAUDATE NUCLEI DUE TO HYPOKINESIA (IZMENENIE KOLICHESTVA TSITOPLAZMATICHESKOI RNK V NEIRONAKH MOTORNOI KORY, I KHYOSTATYKH JADER GOLOVNOGO MOZGA KRYS

KORY I KHVOSTATYKH IADER GOLOVNOGO MOZGA KRYS PRI GIPOKINEZII]

M. D. KALATOZISHVILI (AN GSSR, Institut Fiziologii, Tbilisi, Georgian SSR) Akademiia Nauk Gruzinskoi SSR, Soobshcheniia (ISSN 0132-1447), vol. 133, Feb. 1989, p. 413-416. In Russian. refs

Changes in the amount of cytoplasmic RNA in the rat's motor cortex neurons and caudate nuclei during hypokinesia were investigated using a scanning cytophotometer. The results obtained suggest that changes indicative of a compensatory function of higher nervous system levels develop to different degrees in those areas of the nervous system that are functionally interrelated and are at different levels of phylogenetic development. Details of the experiments and cytoplasmic RNA readings are presented. V.L.

A89-43119#

INCUBATOR FOR CELL CULTURING UNDER MICROGRAVITY [INKUBATOR FUER DIE ZELLKULTIVIERUNG UNTER SCHWERELOSIGKEIT]

OTFRIED JOOP, PETER KERN, and VOLKER STROEBEL Dornier Post (ISSN 0012-5563), no. 3, 1988, p. 40, 41. In German.

Zink, a cell-culture incubator being developed for the second FRG Spacelab mission D2 (scheduled for December 1991), is described. Zink incorporates a 1-g centrifuge and is designed to maintain a temperature of 36.5 + or - 1.0 C for 1-2 weeks; the incubator holds 16 type 1 containers for 1-g experiments or 30 containers for microgravity experiments. Key design parameters include external dimensions $442 \times 357 \times 612 \text{ mm}$, internal dimensions $400 \times 171 \times 474 \text{ mm}$, usable volume 32 I, weight 36 kg or less, and electric power consumption 46 W at cabin temperature 24 C or 62 W at 18 C.

N89-24015*# Florida Univ., Gainesville. Dept. of Engineering Sciences.

ADVANCED SPACE DESIGN PROGRAM TO THE UNIVERSITIES SPACE RESEARCH ASSOCIATION AND THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Final Report, 1987-1988 Academic Year

GALE E. NEVILL, JR. Jun. 1988 264 p

(Contract NGT-21-002-080)

(NASA-CR-180450; NAS 1.26:180450) Avail: NTIS HC A12/MF A01 CSCL 06C

The goal of the Fall 1987 class of EGM 4000 was the investigation of engineering aspects contributing to the development of NASA's Controlled Ecological Life Support System (CELSS). The areas investigated were the geometry of plant growth chambers, automated seeding of plants, remote sensing of plant health, and processing of grain into edible forms. The group investigating variable spacing of individual soybean plants designed growth trays consisting of three dimensional trapezoids arranged in a compact circular configuration. The automated seed manipulation and planting group investigated the electrical and

mechanical properties of wheat seeds and developed three seeding concepts based upon these properties. The plant health and disease sensing group developed a list of reliable plant health indicators and investigated potential detection technologies.

N89-24016*# Florida Univ., Gainesville.

VARIABLE PLANT SPACING

JIM BLEDSOE and LEE WEISS In its Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 41 p Jun. 1988 Avail: NTIS HC A12/MF A01 CSCL 06C

The goal of this project was to develop a system for varying the spacings between soybean plants as they grow to maximize the number of plants grown in a given volume. The project was studied to aid in the development of NASA's Controlled Ecological Life Support System (CELSS). The resulting design consists of plant trays which are three dimensional trapezoids arranged into circles in a compact geometrical configuration. These circles are stacked together in back to back pairs to form a long cylinder. In each growth tray, plants will be housed in individual containers containing a nutrient delivery system and a plant support mechanism. Between the containers, a half trellis has been designed to space the plants for maximum space efficiency. The design allows for localized seeding and harvesting mechanisms due to the chambers' geometrical configuration. In addition, the components have been designed for ease of cleaning and minimal maintenance. Next semester, the individual components will be constructed and tested to determine the success of the design.

Author

N89-24017*# Florida Univ., Gainesville. AUTOMATED SEED MANIPULATION AND PLANTING

RAY GARCIA, JAVIER HERRERA, SCOTT HOLCOMB, PAUL KELLY, SCOTT MYERS, MANNY ROSENDO, HERBERT SIVITZ, and DAVE WOLSEFER *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 32 p Jun. 1988 Avail: NTIS HC A12/MF A01 CSCL 06C

Activities for the Fall Semester, 1987 focused on investigating the mechanical/electrical properties of wheat seeds and forming various Seed Planting System (SPS) concepts based on those properties. The Electrical Division of the design group was formed to devise an SPS using electrostatic charge fields for seeding operations. Experiments concerning seed separation using electrical induction (rearranging of the charges within the seed) were conducted with promising results. The seeds, when exposed to the high voltage and low current field produced by a Van de Graff generator, were observed to move back and forth between two electrodes. An SPS concept has been developed based on this phenomena, and will be developed throughout the Spring Semester, 1988. The Mechanical Division centered on SPS concepts involving valves, pumps, and fluids to separate and deliver seeds. An SPS idea utilizing the pressure difference caused by air as it rushes out of holes drilled in the wall of a closed container has been formulated and will be considered for future development. Also, a system of seed separation and delivery employing a combination of centrifugal force, friction, and air flow was Author considered.

N89-24018*# Florida Univ., Gainesville. PLANT HEALTH SENSING

ARA MANUKIAN, COLLEEN MCKELVY, MICHAEL PEARCE, and STEPH SYSLO *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 34 p Jun. 1988 Avail: NTIS HC A12/MF A01 CSCL 06C

If plants are to be used as a food source for long term space missions, they must be grown in a stable environment where the health of the crops is continuously monitored. The sensor(s) to be used should detect any diseases or health problems before irreversible damage occurs. The method of analysis must be nondestructive and provide instantaneous information on the condition of the crop. In addition, the sensor(s) must be able to

function in microgravity. This first semester, the plant health and disease sensing group concentrated on researching and consulting experts in many fields in attempts to find reliable plant health indicators. Once several indicators were found, technologies that could detect them were investigated. Eventually the three methods chosen to be implemented next semester were stimulus response monitoring, video image processing and chlorophyll level detection. Most of the other technologies investigated this semester are discussed here. They were rejected for various reasons but are included in the report because NASA may wish to consider pursuing them in the future.

N89-24020*# Florida Univ., Gainesville.

AUTOMATED SEED MANIPULATION AND PLANTING

RAY GARCIA, JAVIER HERRERA, SCOTT HOLCOMB, PAUL KELLY, SCOTT MYERS, MANNY ROSENDO, HERBERT SIVITZ, and DAVE WOLSEFER *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 36 p Jun. 1988 Avail: NTIS HC A12/MF A01 CSCL 06C

The Mechanical Division fabricated three seed separators utilizing pressure gradients to move and separate wheat seeds. These separators are called minnow buckets and use air, water, or a combination of both to generate the pressure gradient. Electrostatic fields were employed in the seed separator constructed by the Electrical Division. This separator operates by forcing a temporary electric dipole on the wheat seeds and using charged electrodes to attract and move the seeds. Seed delivery to the hydroponic growth tray is accomplished by the seed cassette. The cassette is compatible with all the seed separators, and it consists of a plastic tube threaded with millipore filter paper. During planting operations, the seeds are placed in an empty cassette. The loaded cassette is then placed in the growth tray and nutrient solution provided. The solution wets the filter paper and capillary action draws the nutrients up to feed the seeds. These seeding systems were tested and showed encouraging results. Seeds were effectively separated and the cassette can support the growth of wheat plants. Problems remaining to be investigated include improving the success of delivering the seeds to the cassette and providing adequate spacing between seeds for the electric separator. Author

N89-24021*# Florida Univ., Gainesville. NON-DESTRUCTIVE PLANT HEALTH SENSING USING ABSORPTION SPECTROSCOPY

JIM BLEDSOE, ARA MANUKIAN, MICHAEL PEARCE, and LEE WEISS *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 56 p Jun. 1988
Avail: NTIS HC A12/MF A01 CSCL 06C

The sensor group of the 1988 EGM 4001 class, working on NASA's Controlled Ecological Life Support Systems (CELSS) project, investigated many different plant health indicators and the technologies used to test them. The project selected by the group was to measure chlorophyll levels using absorption spectroscopy. The spectrometer measures the amount of chlorophyll in a leaf by measuring the intensity of light of a specific wavelength that is passed through a leaf. The three wavelengths of light being used corresponded to the near-IR absorption peaks of chlorophyll a, chlorophyll b, and chlorophyll-free structures. Experimentation showed that the sensor is indeed measuring levels of chlorophyll a and b and their changes before the human eye can see any changes. The detector clamp causes little damage to the leaf and will give fairly accurate readings on similar locations on a leaf, freeing the clamp from having to remain on the same spot of a leaf for all measurements. External light affects the readings only slightly so that measurements may be taken in light or dark environments. Future designs and experimentation will concentrate on reducing the size of the sensor and adapting it to a wider range of plants. Author

N89-24022*# General Electric Co., Moffett Field, CA.
GAS-GRAIN SIMULATION FACILITY: FUNDAMENTAL
STUDIES OF PARTICLE FORMATION AND INTERACTIONS.
VOLUME 1: EXECUTIVE SUMMARY AND OVERVIEW

GUY FOGLEMAN, ed., JUDITH L. HUNTINGTON, ed. (Search for Extraterrestrial Intelligence Inst., Los Altos, CA.), DEBORAH E. SCHWARTZ, ed., and MARK L. FONDA, ed. Mar. 1989 38 p Presented at the Gas-Grain Simulation Facility Experiments Workshop, Sunnyvale, CA, 31 Aug. - 1 Sep. 1987; sponsored by the Exobiology Flight Program

(NASA-CP-10026-VOL-1; A-88256-VOL-1; NAS

1.55:10026-VOL-1) Avail: NTIS HC A03/MF A01 CSCL 06C

An overview of the Gas-Grain Simulation Facility (GGSF) project and its current status is provided. The proceedings of the Gas-Grain Simulation Facility Experiments Workshop are recorded. The goal of the workshop was to define experiments for the GGSF--a small particle microgravity research facility. The workshop addressed the opportunity for performing, in Earth orbit, a wide variety of experiments that involve single small particles (grains) or clouds of particles. The first volume includes the executive summary, overview, scientific justification, history, and planned development of the Facility.

A.D.

N89-24023*# General Electric Co., Moffett Field, CA.
GAS-GRAIN SIMULATION FACILITY: FUNDAMENTAL
STUDIES OF PARTICLE FORMATION AND INTERACTIONS.
VOLUME 2: ABSTRACTS, CANDIDATE EXPERIMENTS AND
FEASIBILITY STUDY

GUY FOGLEMAN, ed., JUDITH L. HUNTINGTON, ed. (Search for Extraterrestrial Intelligence Inst., Los Altos, CA.), DEBORAH E. SCHWARTZ, ed., and MARK L. FONDA, ed. Mar. 1989 199 p Presented at the Gas-Grain Simulation Facility Experiments Workshop, Sunnyvale, CA, 31 Aug. - 1 Sep. 1987; sponsored by the Exobiology Flight Program

(NASA-CP-10026-VOL-2; A-88256-VOL-2; NAS 1.55:10026-VOL-2) Avail: NTIS HC A09/MF A01 CSCL 06C

An overview of the Gas-Grain Simulation Facility (GGSF) project and its current status is provided. The proceedings of the Gas-Grain Simulation Facility Experiments Workshop are recorded. The goal of the workshop was to define experiments for the GGSF--a small particle microgravity research facility. The workshop addressed the opportunity for performing, in Earth orbit, a wide variety of experiments that involve single small particles (grains) or clouds of particles. Twenty experiments from the fields of exobiology, planetary science, astrophysics, atmospheric science, biology, physics, and chemistry were described at the workshop and are outlined in Volume 2. Each experiment description included specific scientific objectives, an outline of the experimental procedure, and the anticipated GGSF performance requirements. Since these experiments represent the types of studies that will ultimately be proposed for the facility, they will be used to define the general science requirements of the GGSF. Also included in the second volume is a physics feasibility study and abstracts of example Gas-Grain Simulation Facility experiments and related experiments in progress.

52

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A89-40498

DEPENDENCE OF OPTOKINETIC NYSTAGMUS ON THE WIDTH OF THE VISION FIELD [ZAVISIMOST' OPTOKINETICHESKOGO NISTAGMA OT SHIRINY POLIA ZRENIJA]

V. S. TODOROVA and V. K. POPOV (B'Igarska Akademiia na

Naukite, Institut po Mekhanika i Biomekhanika, Sofia, Bulgaria) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, March 1989, p. 312-317. In Russian. refs

The effect of the vision field covered by the visual stimulus on the optokinetic response was investigated in normal human subjects. The optokinetic nystagmus (OKN) was elicited by moving vertical gratings of widths ranging from 30 to 170 deg, with a large range of velocities (10-120 deg/sec), and a constant stimulus frequency (0.13 cycle/deg). Results indicate that the parameters of OKN can be changed both qualitatively and quantitatively by changing the width of the stimulus. The optimal OKN was found under conditions of the whole field stimulation. Progressive masking of the periphery caused an OKN reduction whose magnitude was fixed in different stimulus ranges, while eliminating the central stimulation resulted in a complete OKN suppression. The role of the stimulation eccentricity and of the stationary edges in the observed OKN changes is discussed.

A89-40499

SPECTRAL ANALYSIS OF VESTIBULAR NYSTAGMUS [SPEKTRAL'NYI ANALIZ VESTIBULIARNOGO NISTAGMA]

A. V. TELEZHNIKOV, V. G. BAZAROV, L. A. SAVCHUK, I. A. BELIAKOVA, B. G. KADUK (Kievskii Institut Otolaringologii, Kiev, Ukrainian SSR) et al. Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, Mar.-Apr. 1989, p. 18-23. In Russian. refs

A procedure for the spectral analysis of electronystagmograms obtained by rotary stimulation with the rate of 180 deg/sec was developed, that enables the detection of changes in the frequency characteristics which could be used to diagnose a specific pathological hearing condition. The procedure was applied to test 50 subjects, 10 of whom had normal hearing, 20 of whom had Meniere's disease, and 20 of whom suffered from bilateral neuritis of auditory nerves. It was found that, in the periodograms obtained from subjects with Meniere's disease, the third harmonic was not recorded when the right and the left labyrinths were stimulated. In the case of neuritis, the third or the fifth harmonic was absent. The combinations of the nystagram characteristics seen in the two types of pathological cases suggest that the third harmonic reflects the state of the peripheral area of the vestibular analyzer, while the fifth reflects that of the central area.

A89-40825

COMPARATIVE STUDY OF ASTRONAUT MOTOR BEHAVIOR DURING GROUND TRAINING (G = 1) AND DURING ORBITAL FLIGHT (G = 0) [ETUDE COMPARATIVE DU COMPORTEMENT MOTEUR DE L'ASTRONAUTE AU COURS DE L'ENTRAINEMENT AU SOL /G = 1/ ET PENDANT LE VOL ORBITAL /G = 0/]

CAROLE TAFFORIN (Toulouse III, Universite, France) L'Aeronautique et l'Astronautique (ISSN 0001-9275), no. 135, 1989, p. 87-96. In French. refs

The method of Tafforin et al. (1987) is used to analyze video recordings of the motor behavior of astronauts both during ground training and in orbital flight. Larger variations in orientation (with respect to the longitudinal axis) are noted under microgravity conditions, resulting in a larger repertoire of motor and postural activities. The usual vertical posture with limbs extended noted in gravity is replaced in zero gravity by a diversity of postures in which the limbs are predominantly bent.

A89-40851

COAGULATION AND FIBRINOLYSIS IN ACUTE MOUNTAIN SICKNESS AND BEGINNING PULMONARY EDEMA

PETER BAERTSCH, ANDRE HAEBERLI, MARIO FRANCIOLLI, EGBERT K. O. KRUITHOF, and P. WERNER STRAUB (Bern, Universitaet; Laboratoire Central d'Hematologie, Lausanne, Switzerland) Journal of Applied Physiology (ISSN 0161-7567), vol. 66, May 1989, p. 2136-2144. Research supported by the Kommission fuer Sportwissenschaftliche Forschung. refs

The possible relationship between the beginning of the high-altitude pulmonary edema (HAPE) and the parameters of intravascular coagulation and/or decreased fibrinolysis was investigated in 25 male mountaineers after these spent 6, 18, and

42 h at an altitude of 4559 m, which was climbed from an altitude of 550 m in 24 h. The formation of HAPE was assessed by X-ray. Results indicated that, contrary to previously suggested theory of HAPE development, the in vivo fibrin formation and a decreased fibrinolytic activity did not precede the initiation of HAPE (which was observed in six of the 25 subjects), suggesting that these factors were not involved in the initiation of HAPE.

A89-40852 OPERATION EVEREST II - MAXIMAL OXYGEN UPTAKE AT EXTREME ALTITUDE

ALLEN CYMERMAN, JOHN T. REEVES, JOHN R. SUTTON, PAUL B. ROCK, BERTRON M. GROVES (U.S. Army, Research Institute of Environmental Medicine, Natick, MA; Colorado, University, Denver; McMaster University, Hamilton, Canada; California, University, La Jolla; Vermont, University, Burlington) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 66, May 1989, p. 2446-2453. Research supported by the Arctic Institute of North America. refs

(Contract DAMD17-85-C-5206; NIH-HL-14985; NIH-HL-17731)

Maximal oxygen uptake at the height of the Mt. Everest summit was determined in eight male subjects undergoing a simulated ascent to Mt. Everest, in which the barometric pressure in an altitude chamber was progressively reduced over the course of 40 days to the final pressure of 240 torr. The results showed that, under conditions of extreme hypobaric hypoxia, the values of minute respiration volume during maximal exercise were sustained at or near the maximal level measured at the sea level, even though the maximal oxygen consumption was greatly reduced. Subjects with higher values of the maximal oxygen consumption level had higher relative uptakes at the simulated high altitudes.

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A89-40853 OPERATION EVEREST II - ADAPTATIONS IN HUMAN SKELETAL MUSCLE

H. J. GREEN, J. R. SUTTON, A. CYMERMAN, P. M. YOUNG, and C. S. HOUSTON (Waterloo, University; McMaster University, Hamilton, Canada; U.S. Army, Research Institute of Environmental Medicine, Natick, MA; Vermont, University, Burlington) Journal of Applied Physiology (ISSN 0161-7567), vol. 66, May 1989, p. 2454-2461. Research sponsored by the Arctic Institute of North America.

(Contract DAMD17-85-C-5206)

The effects of progressive hypobaria (achieved in human subjects by gradual decompression over 40 days in an altitude chamber to a simulated altitude of the Mt. Everest summit) on skeletal muscles enzymes related to adaptation to hypobaria were investigated by analyzing enzymes from tissue samples extracted from the m. vastus lateralis before decompression (SL-1), at 380 and 282 torr, and upon return to sea level (SL-2). It was found that the activities of enzymes representative of the citric acid cycle, beta-oxidation, glycogenolysis, glycolysis, glucose phosphorylation, and high-energy phosphate transfer did not change as the result of decompression. However, after exposure to 282 torr for additional 7 days, reductions were observed in succinic dehydrogenase, citrate synthetase, and hexokinase between SL-2 and 380 torr. Capillarization was found to be increased in both type I and type II fibers between SL-1 and SL-2. The results do not support the hypothesis that extreme hypobaric hypoxia elicits adaptation directed toward maximizing oxidative function at the level of the muscle cell.

A89-42152* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

ORTHOSTATIC RESPONSES FOLLOWING 30-DAY BED REST DECONDITIONING WITH ISOTONIC AND ISOKINETIC EXERCISE TRAINING

J. E. GREENLEAF, C. E. WADE, and G. LEFTHERIOTIS (NASA, Ames Research Center, Moffett Field; U.S. Army, Letterman Army Institute of Research, San Francisco, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p.

537-542. Research supported by the U.S. Army. refs (Contract NASA TASK 199-21-12)

The effects of intensive exercise training on tilt tolerance following deconditioning of astronauts were investigated by studying orthostatic responses of 19 subjects who underwent two intensive exercise-training regimens during 30 days of -6-deg head-down bed rest (BR). Subjects were divided into no-exercise control group, and two exercise groups, one performing isotonic (Quinton ergometer) exercises, the other doing isokinetic (Lido ergometer) exercises. A 60-deg head-up tilt test was administered on the control day 1 and BR day 30; the test was terminated at 60 min or when presyncopal signs and/or symptoms occurred. It was found that exercise training did not affect tilt tolerance significantly.

A89-42154 EVOKED POTENTIAL AND OTHER CNS REACTIONS DURING A HELIOX DIVE TO 360 MSW

RAGNAR J. VAERNES (Norwegian Underwater Technology Centre, Laksevaag, Norway) and DAG HAMMERBORG (Bergen, Universitetet, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 550-557. refs

The relationships between evoked potential changes and the high-pressure nervous syndrome (HPNS) were investigated. Visual and cognitive evoked responses were determined in six experienced saturation divers predive, during a heliox dive to 360 msw, and postdive, and the evoked-response changes were compared with other neuropsychological and neurophysiological results from the dive. It was found that subjects with mild symptoms and signs of HPNS had normal visual evoked responses, while more marked HPNS effects led to significant increases in the visual evoked latency. The evoked latency changes were related to the overall 'impairment' (sign index) and not to the individual cognitive performance tests, indicating that wave-form analysis can be an important tool for analyzing the overall cognitive inpairment in hyperbaric environments.

A89-42155 PHYSIOLOGICAL AND BEHAVIORAL TEMPERATURE REGULATION OF MEN IN SIMULATED NONUNIFORM THERMAL ENVIRONMENTS BETWEEN 18 AND 30 C

A. R. GWOSDOW and L. G. BERGLUND (Yale University, New Haven, CT) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 558-565. refs (Contract NIH-ES-00354-17; NIH-ES-07086)

The hypothesis that exposure to nonuniform thermal environments increases thermal strain on the body was investigated. Thermoregulatory responses were measured at 18 and 30 C in six sedentary men in whom nonuniform thermal environments were simulated by altering clothing distribution, i.e., clothing was distributed either symmetrically or asymmetrically over the body surface. It was found that, at 18 C, the asymmetric clothing distribution resulted in a higher esophageal temperature. Mean skin temperatures did not differ with clothing distribution at either 18 or 30 C, but at 18 C, the whole-body thermal sensation was warmer for the asymmetric compared to the symmetric group; this increased perception of warmth was significantly correlated to the difference in skin temperature across the body.

A89-42156* Pennsylvania State Univ., University Park. ADAPTATION TO VECTION-INDUCED SYMPTOMS MOTION SICKNESS

ROBERT M. STERN, SENQI HU, MICHAEL W. VASEY, and KENNETH L. KOCH (Pennsylvania State University, University Park and Hershey) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 566-572. refs (Contract NAG9-118)

The effects of repeated exposures to a rotating circular vection drum on the symptoms of motion sickness and tachygastria in humans were investigated. Subjects were sitting in a drum and were exposed to 15 min baseline (no rotation), followed by 15 min drum rotation at 60 deg/s, and, then, by 15 min recovery.

52 AEROSPACE MEDICINE

Gastric myoelectric activity was continuously recorded with the electrogastrogram. Subjects who were exposed to the drum three times with intervals of 4-24 days all showed symptoms of tachygastria and failed to show an amelioration of motion sickness symptoms. On the other hand subjects who had only 48 h between the three sessions of drum exposure, experienced a reduction in motion-sickness symptoms and in tachygastsria upon repeated exposure to the drum, indicating that training effected a symptomatic and physiological adaptation. It is suggested that preflight adaptation to visual-vestibular sensory mismatch may reduce motion sickness in astronauts.

A89-42157 DEPTH PERCEPTION AFTER PROLONGED USAGE OF NIGHT VISION GOGGLES

JAMES B. SHEEHY (U.S. Navy, Naval Air Development Center, Warminster, PA) and MICHAEL WILKINSON (U.S. Marine Corps, Yuma, AZ) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 573-579. refs

The effect of a prolonged usage of night vision goggles (NVGs) on the depth perception was investigated in 12 helicopter pilots/copilots who were tested for stereoscopic depth perception, lateral and vertical phoria, and contrast sensitivity before and after training flights during which the pilots wore either PVS-5A or AN/AVS-6 NVGs for the duration of the flight. Results indicated that, when monocular cues were present, contrast sensitivity and depth perception did not degrade over the course of the mission. On the other hand, lateral phoria tests demonstrated an average exophoric shift of 1.5 prism diopters for 12 out of the 24 missions. Possible causes for the phoria shift are discussed.

A89-42158 RECOVERY OF PUPILLOMOTOR FUNCTION AFTER CATARACT SURGERY

DANIEL R. PETERS and LAWRENCE TYCHSEN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 586-588. refs

To determine the effect of cataract surgery upon pupillomotor function, the pupillary response to light was studied in four subjects who had extracapsular cataract extraction with implantation of an intraocular lens. A video infrared pupillometer was used to record pupillary responses 6-20 weeks after surgery. Nonoperated eyes were compared to operated eyes in each subject. Amplitudes and peak velocities of constriction for operated versus nonoperated eyes differed over a small range (2-14 percent). No evidence of dilation lag or segmental palsy was found in the operated eyes. The latency of constriction was not prolonged. It is concluded that pupillomotor function can be expected to recover in aviators who require routine cataract surgery, and that visual disability due to a poorly dilating or constricting pupil should not be an overriding concern.

A89-42159

OBSERVATIONS ON THE NEUROPHYSIOLOGIC THEORY OF ACCELERATION (+GZ) INDUCED LOSS OF CONSCIOUSNESS JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 589-593. refs

The characteristics of centrifuge +Gz-induced loss of consciousness (G-LOC) have revealed a specific kinetic pattern of resulting physiologic events. The relationship of these events provides an initial basis for describing the possible neurophysiologic mechanism of G-LOC. A description of G-LOC is developed, which divides the G-LOC episode into specific periods based on the psychophysiologic events that occur. Emphasis is placed on the type of acceleration profile which would be most likely to occur during inflight aerial combat maneuvering in fighter aircraft. The symptoms of myoclonic flail movements and memorable dreams which are observed in association with G-LOC may provide key information for unraveling the neurophysiologic mechanism of G-LOC and subsequent recovery.

A89-42439

TESTING FOR IRREGULARITIES OF THE CARDIAC RHYTHM AND CONDUCTION IN FLIGHT PERSONNEL BY MEANS OF A COMBINED FUNCTIONAL TEST [VYIAVLENIE NARUSHENII RITMA SERDTSA I PROVODIMOSTI U LETCHIKOV S POMOSHCH'IU KOMBINIROVANNOI FUNKTSIONAL'NOI PROBY]

E. G. MUKHAMEDOV and V. I. PLAKHATNIUK Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), March 1989, p. 46, 47. In Russian.

A functional test was designed for the detection of irregularities in cardiac rhythm and conduction in otherwise healthy humans, in which subjects are asked to perform deep knee-bends while holding breath. Results of ECGs taken at rest and after the test made it possible to diagnose arrhythmia and cardiogenic blocks in 19 out of seemingly normal 167 subjects, among whom only seven were diagnosed for cardiac arrhythmia before the test. In two of the arrhythmic subjects the combined test induced changes in the character of the arrhythmia. Results of clinical studies indicated that, in eight cases, the arrhythmia and conduction irregularities were caused by infection of nasopharynx and mouth cavity. I.S.

A89-42440

THE VALUE OF POLAROGRAPHIC MEASUREMENTS OF TISSUE-OXYGEN PRESSURE IN EVALUATING FUNCTIONAL STATE OF SEAMEN [ZNACHENIE POLIAROGRAFICHESKOGO ISSLEDOVANIIA NAPRIAZHENIIA KISLORODA V TKANIAKH PRI OTSENKE FUNKTSIONAL'NOGO SOSTOIANIIA ORGANIZMA MORIAKOV]
L. A. TIUNOV and N. M. PETUSHKOV Voenno-Meditsinskii

L. A. TIUNOV and N. M. PETUSHKOV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), March 1989, p. 47-49. In Russian.

The effects of a posttrip rest on the oxygen content and the rate of oxygen consumption in skin tissues of seamen who have returned from an expedition were investigated using polarographic measurements of oxygen pressure (at days 0, 5, 8, 20, 30, and 45 after the trip) in seamen who were exposed to two types of environment during the trip. The first group included seamen who worked at conditions that exposed them to various types of harmful chemicals; the second group had a minimal contact with these chemicals; and the third group constituted controls. It was found that both oxygen pressure and oxygen consumption measured immediately after the trip and 5 days later were significantly lower in subjects of the first group than in the second-group subjects. These differences decreased with posttrip time, and disappeared after the 30th day.

A89-43322

THE AVIATION MEDICAL EXAMINER OF THE 1990S AND BEYOND

STANLEY R. MOHLER (Wright State University, Dayton, OH) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 3-9. refs

Pilot risk factors, both fixed and controllable, which are recommended by the American Medical Association for consideration during the initial screening of pilot applicants and upon periodic examinations of pilots are discussed. Particular attention is given to the individually controllable risk factors, such as obesity; the use of nicotine, drugs, and alcohol; the level of serum lipids that can be controlled by diet; diabetes; nutritional habits; exercise practices; sleep practices; living environments; safety practices; social factors; and self-induced stress syndrome. It is emphasized that a major key to surfacing a covert risk factor is an adequate periodic medical history and physical examination.

A89-43324

FIT TO FLY? SOME COMMON PROBLEMS IN OTOLARYNGOLOGY

P. F. KING (London Independent Hospital, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 19-29.

Some abnormalities discovered in the process of otolaryn-

gological examination of entrants to piloting programs and in established pilots that can affect the fitness to fly are discussed. Attention is given to the diagnosing nasal conditions, such as nasal chronic infection, polyposis, nasal allergy, defected nasal septum, epistaxis, and repaired cleft palate; aural conditions including otitis externa, secretory otitis media, otitis media, perforated drumhead, otosclerosis, sensorineural deafness, vertigo, and acoustic neuroma. The relationship between these conditions and the degree of fitness of the individual in either of these groups are considered, together with measures that can be taken to alleviate these conditions.

A89-43325

MEDICAL SUPPORT FOR MANNED SPACEFLIGHT

R. M. HARDING (Royal Air Force Institute of Aviation Medicine, Farnborough, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 43-55.

Some aspects of medical care provided at all stages of space missions are described, and the problems of medical care associated with the long-duration missions planned for the future are discussed. The procedures used for the screening and selection of American and Russion space crews, the health-stabilization programs in use, the in-flight medical monitoring and the medical equipment on board the spacecraft, and the medical training received by spacecraft crew are examined. Special consideration is given to the post-flight medical care and the quarantine program for space crews involved in visiting extraterrestrial planets. It is emphasized that a detailed series of medical examinations performed throughout the careers of astronauts and cosmonauts provides an ideal data base for longitudinal health studies. A list of some of the potential clinical hazards of a spaceflight is presented.

A89-43640

MAN IN SPACE - A SURVEY OF THE MEDICAL LITERATURE ISABELLE DURAND-ZALESKI Space Power (ISSN 0951-5089), vol. 7. no. 3-4, 1988, p. 353-364. refs

The principal effects and modes of action of the space environment on human physiology are discussed with emphasis on the effects of microgravity on the musculoskeletal and cardiovascular system. Our relative level of knowledge about and ability to compensate for the various effects is highlighted.

Author

N89-24024*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Space Biology and Medicine.

A STRATEGY FOR SPACE BIOLOGY AND MEDICAL SCIENCE FOR THE 1980S AND 1990S

1987 214 p

(Contract NASW-3482)

(NASA-CR-184895; NAS 1.26:184895) Avail: NTIS HC A10/MF A01 CSCL 06C

A guideline is provided for developing NASA's long-term mission plans and a rational, coherent research program. Ten topical areas for research are addressed: developmental biology, gravitropism in plants, sensorimotor integration, bone and mineral metabolism, cardiovascular/pulmonary function, muscle remodeling, nutrition, human reproduction, space anemia, and human behavior. Scientific goals, objectives, and required measurements and facilities for each of the major areas of space biology and medicine are identified and described along with primary goals and objectives for each of these disciplines. Proposals are made concerning the use of scientific panels to oversee the implementation of the strategy, life sciences' need for continuous access to spaceflight opportunities, the advantages of a focused mission strategy, certain design features that will enhance spaceflight experimentation, and general facilities. Other topics that are considered include mission planning, crew selection and training, and interagency and international cooperation. A.D.

N89-24025# Navy Experimental Diving Unit, Panama City, FL. OXYGEN CONSUMPTION RATE OF OPERATIONAL UNDERWATER SWIMMERS Final Report

M. E. KNAFELC Jan. 1989 13 p

(AD-A205331; NEDU-1-89) Avail: NTIS HC A03/MF A01 CSCL 06/4

Prior to evaluating an underwater breathing apparatus (UBA), diver performance must be determined. Previous studies determining the oxygen consumption of swimming and resting divers were done in the laboratory and were limited in scope. Criticisms of those studies suggested that they may not have accurately simulated the underwater work expected of an operational diver. This study measured the oxygen consumption (VO2) sustained by experienced Special Warfare (SPECWAR) operators participating in training exercises. By using a closed-circuit oxygen underwater breathing apparatus, the decrease in the oxygen bottle pressure reflected the amount of oxygen consumed by the diver. These values are comparable to the results of the previous studies. Guidelines reflecting underwater oxygen consumption and estimating carbon dioxide production for calculating carbon dioxide canister duration should be based on the results of these studies. GRA

N89-24026# Armed Forces Radiobiology Research Inst., Bethesda, MD.

A LOW-ENERGY X-RAY IRRADIATOR FOR ELECTROPHYSIOLOGICAL STUDIES

D. A. SCHAUER, G. H. ZEMAN, and T. C. PELLMAR Dec. 1988 35 p

(AD-A205388; AFRRI-TR88-2) Avail: NTIS HC A03/MF A01 CSCL 06/7

A 50 kVp molybdenum target/filter X-ray was installed inside a lead-shielded Faraday cage. High-dose rates of up to 1.54 Gy/min (17.4 keV weighted average photons) were used to conduct local in vitro irradiations of the hippocampal region of guinea pig brains. Electrophysiological recordings of subtle changes in neuronal activity indicate the system is suitable for this application. GRA

N89-24027# Naval Health Research Center, San Diego, CA. Behavior Psychopharmacology Dept.

THE RELATIONSHIP BETWEEN SUBJECTIVE AND OBJECTIVE MEASURES OF SLEEPINESS Interim Report LAVERNE C. JOHNSON, CHARLES R. FREEMAN, CHERYL L. SPINWEBER, and STEVEN A. GOMEZ 7 Dec. 1988 17 p (AD-A205861; NHRC-88-50) Avail: NTIS HC A03/MF A01 CSCL 06/4

The purpose of the present study was to examine the relationship among the Multiple Sleep Latency Test (MSLT), lapses during a tapping task, a visual analog scale (VAS) and the Stanford sleepiness scale (SSS). Subjects were 80 male adult nonsmokers (age 20.3 + or - 2.7 years). The MSLT, SSS, and the VAS were obtained at two-hour intervals beginning at 0700 h. On the MSLT. sleep latency was measured from lights out to first spindle, K-complex or rapid-eye-movement (REM) period. The tapping task (lapses) was administered each day at 0600 h, but became nonsignificant as the day progressed. Correlations of objective and subjective measures from scores summed over both days were not significant. The two objective measures were significantly correlated throughout the day and over days as were the subjective measures. This study reaffirms the importance of time of day in sleepiness, and suggests that subjective and objective measures cannot be used interchangeably and may measure different aspects of sleepiness.

N89-24028# Tennessee Univ., Memphis. Dept. of Physiology and Biophysics.

MURAMYL PEPTIDE-ENHANCED SLEEP: PHARMACOLOGICAL OPTIMIZATION OF PERFORMANCE Annual Report, 1 Jun. 1987 - 31 May 1988

JAMES M. KRÚEGER 1 Jun. 1988 138 p (Contract DAMD17-86-C-6194; DA PROJ. 3M1-61102-BS-10) (AD-A205974) Avail: NTIS HC A07/MF A01 CSCL 06/15

The broad objective of this research is to develop the

52 AEROSPACE MEDICINE

information needed to ascertain whether muramyl peptides (MPs) and/or other endogenous sleep factors (SFs) may be useful as somnogenic agents. Several SFs have been identified that may be involved in the cascade of biomedical events involved in regulation of sleep, e.g., interleukin-1 (IL1). Thus, we think it possible that new more effective somnogenic agents could be developed using MPs and/or other putative SFs. In the second year of this contract six experiments were performed: MP somnogenic activity relationships were determined. The preoptic area (POA) of the brain has been implicated in sleep regulation. Relationships between sleep and infectious disease are examined. Staphylococcus aureus greatly altered rabbit sleep patterns over the course of the infections. Endotoxin and its lipid A moiety are components of gram-negative bacteria that share with MPs the ability to induce increased IL1 production. Alpha-melanocytestimulating hormone (aMSH), proopiomelanocortin-derived peptide which acts as a physiological inhibitor of some of IL1 actions, inhibited normal sleep and also antagonized IL1-enhanced sleep.

Army Research Inst. of Environmental Medicine, N89-24029# Natick, MA.

PATTERNS OF HUMAN DRINKING: EFFECTS OF EXERCISE. WATER TEMPERATURE AND FOOD CONSUMPTION Final Report, Feb. 1988 - Feb. 1989

PATRICIA C. SZLYK, INGRID V. SILS, RALPH P. FRANCESCONI, and ROGER W. HUBBARD 24 Jan. 1989 24 p (AD-A206031; USARIEM-M23-89) Avail: NTIS HC A03/MF A01 CSCL 06/4

The effects of exercise, water temperature and food consumption on patterns of ad libitum drinking were studied in 33 men during 6 consecutive cycles of 30 min walking (4.8 km.h-1, 5 percent grade) and 30 min rest in a climatic chamber (40 C, 40 percent relative humidity). On two nonconsecutive days, subjects consumed 15 C (cool) water during one trial and 40 C (warm) water during the other. We previously reported that two groups of drinkers can be identified during work in the heat by the criterion of Body Weight (BW) loss during the trial. Thus, avid drinkers (D) drank sufficiently such that they lost less than 2 percent of their initial Bw when consuming cool water ad libitum, while Reluctant Drinkers (RD) lost more than 2 percent of their BW. When warm water was provided, fluid consumption was reduced by 29 percent and 54 percent in D and RD, respectively and BW deficits were comparably increased. Intake of cool water elicited cyclic drinking patterns with higher rates during walking than during rest periods in both D and RD, whereas consumption of warm water produced this cyclic pattern only after food ingestion during the third rest. Food consumption stimulated fluid intake and reduced BW losses in both trials. Compared to pre-prandial (hours 1-2.5) rates, average post-lunch drinking rates during the last 3h increased 14 percent in D and 19 percent in RD when consuming cool water, and by 46 percent and 74 percent, respectively with warm water.

Army Research Inst. of Environmental Medicine, N89-24030#

HUMAN TEMPERATURE REGULATION DURING EXERCISE AFTER ORAL PYRIDOSTIGMINE ADMINISTRATION

MARGARET A. KOLKA and LOU A. STEPHENSON Mar. 1989

(AD-A206032; USARIEM-M27-89) Avail: NTIS HC A03/MF A01 CSCL 06/15

Four healthy males exercised in two experiments at ambient temperatures of 22 C, 29 C and 36 C. The relative humidity was 30 percent in each environment. One experiment in each environment was done 150 minutes after oral (30 mg) pyridostigmine bromide (PYR) administration, and the second experiment was done on a separate day with no medication (CON). Red blood cell cholinesterase was -39 (+ or - 7) percent lower after PYR. Esophageal (Tes) and mean skin temperature (Tsk), forearm blood flow (FBF), forearm sweating, and skin blood flow (SkBF) were measured twice each minute during a 15-min rest period and during 30 minutes of seated cycle exercise at approx. 58 percent VO2 peak. Whole body sweating was determined from weight changes before and after exercise. PYR decreased heart rate at rest and during exercise at 29 C and 36 C. Resting SkBF was 40 percent lower at 29 C and 30 percent lower at 36 C after PYR. During exercise, SkBF was 40 percent lower at 29 C and 50 percent lower at 36 C after PYR compared to CON. There was no effect of PYR on heat production at rest or during exercise. Tsk was different in the three conditions by design, but was unchanged by PYR. Tes was not different at rest in any conditions, but was elevated during exercise at 36 C in PYR compared to

N89-24031# Colorado Univ., Denver. Cardiovascular Pulmonary Research Lab.

HUMAN ADAPTATION TO THE TIBETAN PLATEAU Midterm Report, 7 Aug. 1987 - 16 Feb. 1989 LORNA G. MOORE 15 Feb. 1989 10 p

(Contract DAMD17-87-C-7202; DA PROJ. 3E1-62787-A-879) (AD-A206463) Avail: NTIS HC A02/MF A01 CSCL 06/10

Humans live at high altitude for longer periods of time on the Tibetan Plateau than elsewhere in the world, thus providing opportunity to investigate the physiologic effects of longer (years to generations) duration of high altitude exposure. This has military importance because persons are stationed at high altitude locations for extended periods and some of the symptoms of failure to adjust to high altitude require months or years for development. We have completed two field projects (Fall 1987 and 1988) which suggest that Tibetans (natives) possess superior O2 transport and/or utilization systems compared to acclimatized newcomers (Han Chinese). Studies conducted in the period covered by this report addressed the control of breathing and blood oxygenation during sleep. In 22 healthy young men (11 Tibetans, 11 Hans), measurements of the control of breathing and lung volume during wakefulness were examined together with nightime studies of breathing and brain blood flow during sleep. Similar, additional studies were carried out in 8, principally Han patients with chronic mountain sickness and 8 age-matched, healthy controls. The data analysis from these studies is not yet complete but suggests that the Tibetans' greater lung volume, ventilatory sensitivity to hypoxia and high frequency respiratory pattern may confer protection against sleep-disordered breathing and thus better pressure blood oxygenation during sleep.

Krug International, San Antonio, TX. Technology N89-24032# Services Div.

ADDITIVITY OF RETINAL DAMAGE FOR MULTIPLE-PULSE LASER EXPOSURES Final Report, Oct. 1985 - Jan. 1988 JOSEPH A. ZUCLICH and MICHAEL F. BLANKENSTEIN Dec. 1988 25 p

(Contract F33615-84-C-0600)

(AD-A206514; USAFSAM-TR-88-24) Avail: NTIS HC A03/MF A01 CSCL 06/10

This study has examined the cumulative effects of multiple-pulse laser exposures in contributing to retinal damage via a thermal mechanism. Three sets of experiments have been conducted to determine the variation of multiple-pulse thresholds: with the interval between pulses; with the number of pulses in the pulse train when the interpulse interval is held constant; and with the retinal image size when both number of pulses and interpulse interval are invariant. In addition, thermal model calculations were carried out to compare model predictions with the experimental data. Conclusions from the experimental data are: (1) The threshold for a multiple-pulse train is related to that for an individual pulse in the train by a function of the number of pulses, but is independent of pulse-repetition frequency and pulse train length. This observation is in general accordance both with the thermal model predictions and with previously empirical models. (2) The additivity of multiple pulses is quantitatively similar for collimated and expanded laser beams incident at the eye. (3) The repair or recovery of laser-induced reversible retinal damage (i.e., sub-threshold with respect to the ophthalmoscopic lesion endpoint) is slow, having a time constant of the order of days.

N89-24369# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.

MEDICAL AND RADIATION PROTECTION PROBLEMS IN SPACE

K. E. KLEIN and H. BUECKER In ESA, International Symposium on Europe in Space: The Manned Space System p 291-302 Oct. 1988

Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Possibilities of inflight disturbances to space missions due to diseases, operation, and environment are discussed. Equipment needed for diagnosis and treatment is considered. Countermeasures are considered. Research required on the radiation hazard to space crews is suggested, including the measurement of radiation in space, the determination of its biological significance, and the establishment of radiation protection standards and of a system of dosimetric surveillance.

N89-24785# Army Research Inst. of Environmental Medicine, Natick, MA.

SOLUTE MODEL OR CELLULAR ENERGY MODEL: PRACTICAL AND THEORETICAL ASPECTS OF THIRST DURING EXERCISE

ROGER W. HUBBARD, PATRICK C. SZLYK, and LAWRENCE E. ARMSTRONG 16 Feb. 1989 32 p

(AD-A206143; USARIEM-M22/89) Avail: NTIS HC A03/MF A01 CSCL 06/10

Most physiologists would agree that repaying the water debt incurred through evaporative cooling is part of the physiological cost of work in the heat. Pitts and coworkers emphasized that, during work in the heat, men never voluntarily drink as much water as they lose and usually replace only two-thirds of the net water loss. Rothstein et al. observed that this occurred even when water was available, and called this phenomenon voluntary dehydration. Some physiologists feel that voluntary dehydration occurs because thirst is an inadequate stimulus to drinking. On the other hand, Vokes contends one of the best examples of a perfectly functioning homeostatic system is water balance. One of our goals is to reconcile the fact that under certain conditions, both of these statements are correct. We will also try to switch the readers interest from water to salt for, although man may drink, water cannot be held until the missing osmoles are made good. This may be seen as at least one explanation of why thirst is inadequate and there are others.

N89-24786# State Univ. of New York, Plattsburgh. Auditory Research Lab.

THE EFFECTS OF BLAST TRAUMA (IMPULSE NOISE) ON HEARING: A PARAMETRIC STUDY Annual Report, 1 Apr. 1986 - 31 Mar. 1987

ROGER P. HAMERNIK, WILLIAM A. AHROON, ROBERT I. DAVIS, and GEORGE A. TURRENTINE 22 Jul. 1988 332 p (Contract DAMD17-86-C-6172; DA PROJ. 3M1-61102-BS-15) (AD-A206180; ARL-88-2) Avail: NTIS HC A15/MF A01 CSCL 06/10

There are three broad goals to this project. The first and primary goal is to begin the systematic development of a data base from which one could estimate the hazards to hearing resulting from exposure to blast waves or other high level impulse noise transients. To achieve this primary objective the following two objectives must first be achieved: (1) to develop a methodology to efficiently acquire data on a large number of experimental animals that have been exposed to a variety of blast wave configurations. This includes audiometric, histological and acoustic variables; (2) to develop a set of blast wave simulation devices which can reliably generate blast waves with a variable distribution of spectral energy in a laboratory environment. This report will describe progress that was achieved on each of these objectives. Data acquisition was completed on 40 chinchillas that were exposed to one of a series of very low frequency (125 Hz) energy-content blast wave exposure paradigms. This data represents the completion of the first of four phases of a parametric study that was designed to estimate the contributions of individual blast wave exposure variables on the production hearing loss. Hearing function was measured using the auditory evoked potential (AEP) technique. The evaluation of hearing consisted of pre- and postexposure measurements of pure tone thresholds and tuning curves (masked thresholds).

N89-24787# School of Aerospace Medicine, Brooks AFB, TX. CEREBRAL LATERALITY AND HANDEDNESS IN AVIATION: PERFORMANCE AND SELECTION IMPLICATIONS Final Report, Jul. 1987 - Jun. 1988

JOHN S. CROWLEY Jan. 1989 101 p (AD-A206196; USAFSAM-TP-88-11) Avail: NTIS HC A06/MF A01 CSCL 05/8

This paper reviews the general psychology literature related to handedness and cerebral laterality, beginning with a brief discussion of the research methods employed. Aspects of laterality, including vision, audition, tactile perception, spatial ability, and language are reviewed, as well as theories of cerebral dominance patterns. The handedness literature is examined, with attention to measurement, theories of genesis, sociocultural factors, and sex differences. There are many postulated correlates of human laterality, including performance, occupation, emotions, and various diseases. References, suggest that pilots who have no strong hand preference may be at a slight disadvantage in the cockpit, whereas those who are consistently right-side dominant tend to do well. Current neuropsychological theory would suggest that the ideal aviator brain should be well lateralized, to minimize competition for hemispheric resources. There is evidence that pilots who are poorly lateralized may exhibit traits of right-left confusion. Several aircraft accidents have been attributed to pilots failing to correctly distinguish between left and right. Performance in flight school seems to be associated with right hemispheric (visuospatial) ability, as measured by tests of cognitive function. These tests have utility in the selection of aircrew; techniques for enhancing cognitive laterality may also prove useful.

N89-24788# Georgia State Univ., Atlanta. NEUROCHEMICAL CONTROL OF CIRCADIAN RHYTHMS Annual Report, 1 Apr. 1988 - 31 Mar. 1989 ALBERS H. ELLIOTT 20 Mar. 1989 9 p

(Contract N00014-87-K-0172; RR04108)

(AD-A206213) Avail: NTIS HC A02/MF A01 CSCL 06/1

We have continued our investigation of the neurochemical systems contained in the circadian clock localized within the suprachiasmatic nucleus (SCN). Our primary focus has been to determine the circadian functions of a subpopulation of SCN interneurons in which vasoactive intestinal peptide (VIP), peptide histidine isoleucine (PHI) and gastrin releasing peptide (GRP) have been co-localized. In these studies we have demonstrated: (1) VIP/PHI neurons are found in the ventrolateral SCN where photic projections terminate. (2) a rhythm of VIP/PHI mRNA within the SCN that correlates with day-night cycle, (3) a modulation of SCN content of VIP and PHI by environmental lighting, (4) combined microinjection of VIP/PHI/GRP into the SCN mimics the phase delay of circadian rhythms produced by light, and (5) VIP/PHI/GRP alters the electrical activity of SCN single units. In other studies we have investigated the possible circadian functions of arginine vasopressin, GABA and neuropeptide Y (NPY) within the SCN, and the role of NPY within the para-ventricular nucleus on corticosterone secretion. GRA

N89-24789# Army Research Inst. of Environmental Medicine, Natick, MA.

IS SALT AT FAULT

LAWRENCE E. ARMSTRONG and ROBERT H. LIND 28 Feb. 1989 12 p

(AD-A206518; USARIEM-M26/89) Avail: NTIS HC A03/MF A01 CSCL 06/8

This article reviews the fluid-electrolyte balance which is altered by exercise in hot environments at a variety of durations--focusing on sodium chloride losses. Recommendations are presented to

52 AEROSPACE MEDICINE

assist athletes in maintaining electrolyte balance practically. Because of the journal involved, athletic situations and circumstances are highlighted.

National Aeronautics and Space Administration. N89-24790*# Lyndon B. Johnson Space Center, Houston, TX.

A METHOD OF ISOLATING TREADMILL SHOCK AND

VIBRATION ON SPACECRAFT

WILLIAM E. THORNTON Apr. 1989 18 p (NASA-TM-100474; S-591; NAS 1.15:100474) Avail: NTIS HC A03/MF A01 CSCL 06/19

A major problem is currently felt to exist in the implementation of materials processing on a spacecraft. Crystal growers place requirements of one micro-g or less on the vehicle. Simple math produces startling figures for such a restriction e.g., for each ton of vehicle mass with 10(-6) g acceleration limit; Perturbing Force limit, F = .002 lb. For each 10(5) lbs F = 0.1 lb. For each 10(6) lbs F = 1.0 lb. Forces generated by normal human movement on spacecraft of 5x10(5) pounds weight are on an order-of-magnitude greater than allowed by this specification and forces generated by locomotion on a treadmill are more than two orders-of-magnitude greater. Other exercises and normal onboard functions generate forces in between. To accommodate many essential functions it is obvious that even on a vehicle as large as Space Station, a reduction of more than two orders of magnitude in force is required. Commonly used passive shock and vibration isolation devices are complex, heavy, and also would have difficulty meeting the requirements. However, by a new arrangement, adequate isolation can be obtained. Isolation of the treadmill will be treated since it is considered the most significant disturbance at this time.

Author

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A89-42160

TRIAZOLAM IMPAIRS LEARNING AND FAILS TO IMPROVE SLEEP IN A LONG-RANGE AERIAL DEPLOYMENT

DAVID M. PENETAR, GREGORY BELENKY, JAMES J. GARRIGAN, and DANIEL P. REDMOND (U.S. Army, Walter Reed Army Institute of Research, Washington, DC; U.S. Army, Medical Research Unit, Fort Bragg, NC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 594-598. refs

The effect of triazolam as a sleep-inducing drug was investigated in U.S. soldiers deployed on a field exercise in the Middle East, who received either placebo or 0.5 mg of triazolam once they were airborne on their journey. Sleep and activity were measured during the flight by means of a wrist-worn activity monitor, while the mood, cognitive performance, and sleepiness were assessed during a refueling stop 8 h after the drug administration. It was found that triazolam did not increase the duration or improve the continuity of sleep during the 8-h flight, nor did it affect the mood or sleepiness. On the other hand, the ability to recall verbal material presented prior to testing was impaired 8 h after ingestion.

A89-42162 AIRCRAFT COORDINATION TRAINING IN THE U.S. AIR **FORCE AIR TRAINING COMMAND**

JOHN A. SHAUD (USAF, Air Training Command, Randolph AFB, Aviation, Space, and Environmental Medicine (ISSN TX) 0095-6562), vol. 60, June 1989, p. 601, 602.

Coordinated action among the various members of a multi-crew aircraft is essential for safe flight. Aircrew coordination problems typically fall into one of three broad categories: (1) improper task prioritization, (2) ineffective communication, or (3) lack of coordinated action. The airlines and the Military Airlift Command have very successful crew coordination training programs. The Air Training Command (ATC) wil soon transition to a specialized pilot training program where pilots destined for large multi-place aircraft will be trained differently from those who will fly fighter aircraft. Under this new training program, ATC will help establish a crew mind-set early in the new multi-place pilot's career by providing initial crew coordination training.

A89-42163

INTERPERSONAL AND GROUP-BEHAVIOR SKILLS TRAINING FOR CREWS ON SPACE STATION

JOHN M. NICHOLAS (Loyola University, Chicago, IL) Space, and Environmental Medicine (ISSN 0095-6562), vol. 60. June 1989, p. 603-608. Research supported by Loyola University.

With the advent of Space Station, planners must come to terms with the inevitable psychosocial crew problems that accompany long-term confinement. Although some problems may be resolvable with the assistance of an on-board professional therapistconsultant, others can only be settled by whole-crew training in interpersonal, emotional-support, and group-interaction skills. This article describes problem situations, kinds of skills training needed to resolve them, and the resistance that proposals for behavioral training might encounter.

A89-43323

CABIN STAFF'S PERCEPTION OF THE IMPACT OF FLYING ON THEIR PHYSICAL HEALTH

CLAIRE MARRISON and HELEN MUIR (Cranfield Institute of Technology, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 11-17. refs

The impact of individual, operational, and workload variables on physical health of the cabin staff of commercial airlines was assessed in 453 subjects using a self-completion questionnaire, based on the questionnaire designed by Kobrick and Sampson (1979), which was completed after flight. Biographical data, roster information, and data on pre-flight and post-flight measures of stress and fatigue were also collected. Results demonstrated the existence of multifaceted effects on physical health and the complexity of the interactions which exist between health, stress, and fatigue. The major 'occupational hazard' for cabin staff was found to be physical discomfort. The severity of the symptoms experienced were influenced by the employment status, age, and length of employment. Operational and workload variables were also found to play a role in the determination of the level of physical discomfort.

N89-24033*# McDonnell-Douglas Corp., Long Beach, CA. CREW PROCEDURES AND WORKLOAD OF RETROFIT **CONCEPTS FOR MICROWAVE LANDING SYSTEM**

LELAND G. SUMMERS and JON E. JONSSON May 1989

(Contract NAS1-18028)

(NASA-CR-181700; NÁS 1.26:181700; MDC-K1413) Avail: NTIS HC A03/MF A01 CSCL 05/9

Crew procedures and workload for Microwave Landing Systems (MLS) that could be retrofitted into existing transport aircraft were evaluated. Two MLS receiver concepts were developed. One is capable of capturing a runway centerline and the other is capable of capturing a segmented approach path. Crew procedures were identified and crew task analyses were performed using each concept. Crew workload comparisons were made between the MLS concepts and an ILS baseline using a task-timeline workload model. Workload indexes were obtained for each scenario. The results showed that workload was comparable to the ILS baseline for the MLS centerline capture concept, but significantly higher for the segmented path capture concept. Author

N89-24034# Naval Submarine Medical Research Lab., Groton,

PSYCHOMETRIC FUNCTION RECONSTRUCTION FROM **ADAPTIVE TRACKING PROCEDURES Interim Report**

MARJORIE R. LEEK, THOMAS E. HANNA, and LYNNE MARSHALL 29 Nov. 1988 26 p (AD-A205668; NSMRL-1095) Avail: NTIS HC A03/MF A01 CSCL 05/8

Adaptive psychophysical procedures have come into widespread use for the estimation of psychophysical performance. Their popularity arises from their speed of implementation and efficiency in the stimulus levels far removed from the selected target values are seldom presented. Thus, experimental time and subject energy can be devoted to a precise delineation of performance at and around the target or threshold region. However, sometimes it is valuable to be able to describe a subject's performance across a wide range of stimulus values by construction of a psychometric function showing how performance changes with changing stimulus values. Since adaptive tracking procedures are specifically assigned to avoid stimulus levels far from the target value, the psychometric function constructed from the data in the track may be precisely defined near the target where there are many trial presentations for each level, but be a poor reflection of performance at levels removed from the target. While some authors have attempted to analyze the trial-by-trial data produced by an adaptive track to construct a psychometric function, there is little evidence that the functions they report do, in fact, represent the underlying function governing subject performance.

N89-24035# Navy Personnel Research and Development Center, San Diego, CA.

DEVELOPMENT AND EVALUATION OF INTEGRATING DETAILS: A COMPLEX SPATIAL PROBLEM SOLVING TEST Technical Report, Jan. 1986 - Jun. 1988

DAVID L. ALDERTON Feb. 1989 58 p (AD-A205860; NPRDC-TR-89-6) Avaii: NTIS HC A04/MF A01 CSCL 05/9

This report summarizes the theory behind and the development, evaluation, and refinement of a complex spatial processing test. Integrating Details. In the course of revamping and making the Armed Services Vocational Aptitude Battery (ASVAB) adaptive, the opportunity exists for replacing or adding test to the battery. Tests of spatial ability, a major dimension of human intelligence, are not represented in the ASVAB so they are reasonable candidates for inclusion. The vast psychometric literature on spatial ability suggests that only complex spatial tests are likely to be valid for both school and job performance. Theoretical and empirical work from visual cognition and mental imagery provided further guidelines for the development of a complex spatial test. Methodological techniques from componential analysis were used to initiate the test and develop an information processing model for test item solution. The results suggest that Integrating Details is a complex spatial problem solving test, that is relatively independent of verbal ability, that the test is reliable and has substantial construct validity. Furthermore, analyses demonstrate that the ability measured by Integrating Details is substantially unique from those measured by the ASVAB and thus there is ample opportunity for the test to augment the predictive validity of the ASVAB. A final 40-item version of the test is recommended for advanced development and validation with military enlisted personnel.

N89-24036# South Dakota Univ., Vermillion. Human Factors Lab.

QUASI-MONOCHROMATIC VISUAL ENVIRONMENTS AND THE RESTING POINT OF ACCOMMODATION

EDWARD TRAUTMAN, VERNON ELLINGSTAD, MICHAEL LILIENTHAL (Naval Training Systems Center, Orlando, FL.), and MARY A. TRAUTMAN 1988 81 p Sponsored by Navy (AD-A205938; NTSC-TR-88-028) Avail: NTIS HC A05/MF A01 CSCL 06/4

This investigation explored the importance of color as a factor in deterioration of correct visual accommodation and involuntary regression to the resting point of accommodation. The involvement of voluntary control of accommodation processes was manipulated by requiring extended performance on a difficult visual task. Broad band red and green as well as white visual environments were

presented in two related experiments. The first considered color, light level and time on task. The second attempted a more specific examination of color and time on task. Expected light level, time on task and chromatic aberration effects were evident. Declining light levels and extended time on task produced expected decrements in accommodation. Ambient color environments produced predictable differential accommodation. No statistically significant differences were revealed to support the possibility of color mediated differential regression to resting point of accommodation.

N89-24037# Duke Univ., Durham, NC. Center for Decision Studies.

MONITORING INFORMATION PROCESSING AND DECISIONS: THE MOUSELAB SYSTEM

ERIC J. JOHNSON, JOHN W. PAYNE, JAMES R. BETTMAN, and DAVID A. SCHKADE Feb. 1989 56 p (Contract N00014-80-C-0114; RR04209)

(AD-A205963; ONR-TR-89-4) Avail: NTIS HC A04/MF A01 CSCL 12/5

In order to better understand the cognitive processes underlying judgment and choice, decision researchers have begun to use a variety of process tracing techniques. The idea is to complement many traditional measures of judgment and choice with a high density of observations on the intermediate stages of processing. This report documents a procedure for monitoring the information acquisition stages of decision behavior. The procedure is based on a micro-computer controlled pointing device called a mouse. The procedure offers a number of flexible graphics and data recording routines. The relationship of the procedure to other process tracing techniques is discussed.

N89-24038# City of Hope Medical Center, Duarte, CA.
LONG TERM SYNAPTIC PLASTICITY AND LEARNING IN
NEURONAL NETWORKS Final Technical Report, 15 Aug. 1986
- 14 Nov. 1988

THOMAS H. BROWN 14 Jan. 1989 13 p (Contract F49620-86-C-0099)

(AD-A205993; AFOSR-89-0361TR) Avail: NTIS HC A03/MF A01 CSCL 06/1

The purpose of this project was to understand rapidly induced and persistent forms of synaptic memory. The properties of the synaptic modifications underlying this plasticity could account for some of the adaptive and self organizing capabilities of simple and well-defined neurobiological networks in the mammalian brain. These can be studied rigorously using neurophysiological and optical techniques. Sprearheading the project effort was the working hypothesis that long-term synaptic potentiation (LTP), a use-dependent enhancement of synaptic transmission, may mediate certain mnemonic functions of hippocampal circuitry and other forebrain structures. The project was organized around four categories of interrelated specific aims. First, new quantal analysis methods were developed and tested (Aim 2) using patch-clamp techniques to study charge fluctuations of synaptic transmission during LTP at the crayfish neuromuscular junction. Accomplishment of this aim was necessary in order to be able to transfer and apply the new method to analyze and learn the biophysical mechanisms underlying LTP in hippocampal synapses (Aim 1) a much more difficult preparation to study at this level.

N89-24039# Army Research Inst. of Environmental Medicine, Natick, MA.

TREATMENT WITH TYROSINE, A NEUROTRANSMITTER PRECURSOR, REDUCES ENVIRONMENTAL STRESS IN HUMANS

LOUIS E. BANDERET and HARRIS R. LIEBERMAN 1988 17 p

(AD-A206035; USARIEM-M17-89) Avail: NTIS HC A03/MF A01 CSCL 06/15

Acutely stressful situations can disrupt behavior and deplete brain norepinephrine and dopamine, catecholaminergic neurotransmitters. In animals, administration of tyrosine, a food constituent and precursor of the catecholamines, reduces these

behavioral and neurochemical deficits. Using a double-blind. placebo-controlled crossover design we investigated whether tyrosine (100 mg/kg) would protect humans from some of the adverse consequences of a 4.5 hour exposure to cold and hypoxia. Tyrosine significantly decreased symptoms, adverse moods, and performance impairments in subjects who exhibited average or greater responses to these environmental conditions. These results suggest that treatment with tyrosine should be evaluated in a variety of acutely stressful situations for beneficial behavioral effects.

N89-24040# Washington Univ., Saint Louis, MO. Dept. of Neurology.

THE ATTENTION SYSTEM OF THE HUMAN BRAIN

MICHAEL I. POSNER and STEVEN E. PETERSEN 28 Feb. 1989 31 p

(Contract N00014-86-K-0289)

(AD-A206157; TR-89-1) Avail: NTIS HC A03/MF A01 CSCL 05/8

The concept of attention as central to human performance extends back to the start of experimental psychology, yet even a few years ago, it would not have been possible to outline in even a preliminary form a functional anatomy of the human attentional system. New developments in neuroscience have opened the study of higher cognition to physiological analysis, and have revealed a system of anatomical areas that appear to be basic to the selection of information for focal (conscious) processing. The importance of attention is its unique role in connecting the mental level of description of processes used in cognitive science with the anatomical level common in neuroscience. Sperry describes the central role that mental concepts play in understanding brain function. As is the case for sensory and motor systems of the brain, our knowledge of the anatomy of attention is incomplete. Nevertheless, we can now begin to identify some principles of organization that allow attention to function as a unified system for the control of mental processing. Although many of our points are still speculative and controversial, we believe they constitute a basis for more detailed studies of attention from a cognitive-neuroscience viewpoint. Perhaps even more important for furthering future studies, multiple methods of mental chronometry, brain lesions, electrophysiology, and several types of neuro-imaging have converged on common findings.

N89-24041# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE ROLE OF KNOWLEDGE IN VISUAL SHAPE REPRESENTATION Ph.D. Thesis

ERIC SAUND Oct. 1988 303 p

(Contract N00014-85-K-0124)

(AD-A206173; AI-TR-1092) Avail: NTIS HC A14/MF A01 CSCL

This thesis shows how knowledge about the visual world can be built into a shape representation in the form of a descriptive vocabulary making explicit the important spatial events and geometrical relationships comprising an object's shape. We offer two specific computational tools establishing a framework by which a shape representation may support a variety of later visual processing tasks: (1) By maintaining shape tokens on a Scale-Space Blackboard, information about configurations of shape events such as contours and regions can be manipulated symbolically, while the pictorial organization inherent to a shape's spatial geometry is preserved. (2) Through the device of dimensionality-reduction, configurations of shape tokens can be interpreted in terms of their membership within deformation classes: this provides leverage in distinguishing shapes on the basis of subtle variations reflecting deformations in their forms. The power in these tools derives from their contributions to capturing knowledge about the visual world. In contrast to building block approaches to shape representation we employ a large and extensible vocabulary of shape descriptions tailored to the constraints and regularities of particular shape worlds.

N89-24042# Washington Univ., Saint Louis, MO. Dept. of Neurology and Neurological Surgery.

RELATING ATTENTION TO VISUAL MECHANISMS

GORDON L. SHULMAN 28 Feb. 1989 (Contract N00014-86-K-0289; RR04206)

(AD-A206452; ONR-TR-89-2) Avail: NTIS HC A03/MF A01 **CSCL 06/4**

The effect of attention on visual perception has been a subject of great controversy. Much research on attention over the last thirty years has been framed by the debate on this question between proponents of early and late selection. Late selection theorists have argued that all perceptual encoding, including recognition, and certain semantic analyses are accomplished in parallel, while early selection theorists have countered that only simple physical analyses can be conducted in parallel. More sophisticated analyses of shape that support object recognition and memory access are conducted by limited capacity systems. Although the terms perceptual and semantic include a wide variety of processes, there has been an unfortunate tendency to extrapolate conclusions to the entire collection of processes based on results from a few. For example, researchers have tacitly assumed that if any evidence for semantic processing of unattended material is found, then perceptual operations must be parallel. This inference, however, only applies to the perceptual operations relevant to the recognition of the experimental stimuli, which are generally upright block alphanumeric characters. Recognition of these stimuli does not require the resolution of a vast number of problems the visual system must solve: the analysis of motion, three-dimensional space, constancies of various sorts.

N89-24374# European Space Agency, Paris (France). THE TRAINING CONCEPT FOR ESA ASTRONAUTS AND THE **ASSOCIATED FACILITIES**

H. D. HOPKINS In its International Symposium on Europe in Space: The Manned Space System p 367-369 Oct. 1988 Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The number of astronauts required for the Hermes program is estimated at 12. Training facilities needed are determined for basic training and specialized and mission training.

N89-24375# Centre National d'Etudes Spatiales, Toulouse (France)

THE HERMES SYSTEM TRAINING CONCEPT (CONCEPT D'ENTRAINEMENT AU SYSTEME HERMES]

G. GARGIR In ESA, International Symposium on Europe in Space: The Manned Space System p 371-377 Oct. 1988 In FRENCH; **ENGLISH summary**

Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Hermes crew, crew activities, and astronaut training are discussed. Hermes astronauts will be flight crew members, mission engineers, and passengers bound for space stations. The type of training required for each type of astronaut is shown, along with the number of hours at each particular facility e.g., 1800 hr of mission training for the pilot, including 240 hr with the Hermes training airplane.

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). **CREW TRAINING ASPECTS**

J. DEMOND, W. MUELLER-BREITKREUTZ, and H. G. NEUHAEUSER In ESA, International Symposium on Europe in Space: The Manned Space System p 541-549 Oct. 1988 Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Astronaut training for Hermes and Columbus is discussed. Experience from the German Spacelab missions is reviewed and training facilities needed for Hermes and Columbus are indicated. Two main types of facilities are proposed: an integrated system. training facility with full scale mock-ups of the specific space elements; and single system training facilities, which allow training on single subsystems or payload elements.

N89-24791# Army Research Inst. of Environmental Medicine, Natick, MA.

FIELD-DEPENDENCE AND JUDGMENT OF WEIGHT AND COLOR REVISITED: SOME IMPLICATIONS FOR THE STUDY OF SENSORY DISCRIMINATION

BERNARD J. FINE Jan. 1989 20 p Submitted for publication (Contract DA PROJ. 3M1-61102-BS-15)

(AD-A206141; USARIEM-M20/89) Avail: NTIS HC A02/MF A01 CSCL 05/8

Based on a construct termed sensitivity of the nervous system and the assumption that field-dependence is an indirect approximation of level of sensitivity, our previous research has predicted and found field-independent groups to be superior to field-dependent groups in color and weight discrimination and in contrast sensitivity. Here, we re-examine weight judgment using a more discriminating test and attempt to replicate previous color results. Seventeen females performed a weight discrimination task (15 weights, 75 to 145 grams, in 5-gram increments) on two successive days, three trials/day, and two trials on the Farnsworth-Munsell 100 Hue Test. A field-independent group (N=5) performed significantly better than a field-dependent group (N=6) on all trials of both tasks. Although N is small, this is the fifth replication (in five attempts) of the color discrimination results and a strong validation of the previous results with weights. It is suggested that in studies of sensory discrimination, some of the so-called random error now must be considered as systematic error, or bias, and that attention should be given to level of sensitivity of participants.

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A89-40811#

A FORMULATION FOR STUDYING DYNAMICS OF THE SPACE STATION BASED MRMS AND ITS APPLICATION

YASUHIRO MORITA and VINOD J. MODI (British Columbia, University, Vancouver, Canada) Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663), vol. 37, no. 422, 1989, p. 128-134. In Japanese, with abstract in English. refs

A relatively general formulation for studying dynamics of a flexible Mobile Remote Manipulator System (MRMS), supported by an orbiting flexible platform, is developed using the Lagrangian approach with generalized forces accounting for the environmental effects, damping, and control. The computational algorithm is so structured as to isolate the effects of various system parameters, thus helping in assessment of their relative importance. Application of the general formulation, illustrated through several typical MRMS configurations of practical importance, reveals complex interactions between vibrational and librational degrees of freedom, in the presence of MRMS maneuver, over a range of system parameters and initial conditions. Effectiveness of the formulation is also demonstrated through another illustrative example of the SCOLE configuration representing the Shuttle-based flexible beam Author supporting a rigid reflector plate at its end.

A89-41457

SPACE ROBOTICS - INTRA-VEHICULAR OPERATIONS

BARRY KEEPENCE (Marcol Computer Systems, Ltd., Bristol, England) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 42, May 1989, p. 239-246. refs

The introduction of robotics in space will have a major impact on payload, spacecraft, and ground station design and operations. An intelligent and advanced robot could perform many tasks as well as or even better than astronauts. The possible applications of robots in Space are manifold but, in the near future, first applications are likely to be intra-vehicular. This paper analyses and considers payload requirements in the context of robotic operations. The specific requirements and constraints of a robot operating in space are examined. The problems of teleoperation, teleprogramming and the implications of integrating robotics into telescience operations are discussed.

A89-42153* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

THE EFFECTS OF WINDOW SHAPE AND RETICLE PRESENCE ON PERFORMANCE IN A VERTICAL ALIGNMENT TASK

ERIKA L. ROSENBERG, RICHARD F. HAINES, and KEVIN JORDAN (NASA, Ames Research Center, Moffett Field; San Jose State University, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 543-549. refs (Contract NCC2-327)

This study was conducted to evaluate the effect of selected interior work-station orientational cuing upon the ability to align a target image with local vertical in the frontal plane. Angular error from gravitational vertical in an alignment task was measured for 20 observers viewing through two window shapes (square, round), two initial orientations of a computer-generated space shuttle image, and the presence or absence of a stabilized optical alignment reticle. In terms of overall accuracy, it was found that observer error was significantly smaller for the square window and reticle-present conditions than for the round window and reticle-absent conditions. Response bias data reflected an overall tendency to undershoot and greater variability of response in the round window/no reticle condition. These results suggest that environmental cuing information, such as that provided by square window frames and alignment reticles, may aid in subjective orientation and increase accuracy of response in a Space Station proximity operations alignment task.

A89-42728 ERGONOMIC DESIGN FOR PERSPECTIVE FLIGHT-PATH DISPLAYS

CHRISTOPHER D. WICKENS, IAN HASKELL, and KAREN HARTE (Illinois, University, Savoy) (IEEE, International Conference on Systems, Man, and Cybernetics, Beijing and Shenyang, People's Republic of China, Aug. 8-12, 1988) IEEE Control Systems Magazine (ISSN 0272-1708), vol. 9, June 1989, p. 3-8. Research sponsored by the Boeing Commercial Aircraft Co. refs

The design and evaluation for the display of a four-dimensional perspective flight-path predictor (X, Y, Z, and time) are described. Five basic principles of human performance are used to guide the choice of display configuration: working memory limitations, object integrality, compatibility, consistency, and visual momentum. Each principle is discussed along with the corresponding display and experimental design. Twenty-four pilots flew simulated approaches to North American airports, using one of three displays: (1) a display with four-dimensional preview and predictor information, which was configured with inside-out perspective; (2) the same display configured with outside-in perspective; or (3) an inside-out flight director with neither preview nor predictor. The results revealed an advantage for predictor/preview information, which was greatest with the inside-out perspective. The display aids did not appear to be helpful.

A89-42808

RESOLVED MOTION RATE CONTROL OF SPACE MANIPULATORS WITH GENERALIZED JACOBIAN MATRIX

YOJI UMETANI and KAZUYA YOSHIDA (Tokyo Institute of Technology, Japan) IEEE Transactions on Robotics and Automation (ISSN 1042-296X), vol. 5, June 1989, p. 303-314.

The authors establish a control method for space manipulators taking dynamical interaction between the manipulator arm and the base satellite into account. The kinematics of free-flying multibody systems is investigated by introducing the momentum conservation

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

law into the formulation and a novel Jacobian matrix in generalized form for space robotic arms is derived. The authors develop a control method for space manipulators based on the resolved motion control concept. The proposed method is widely applicable in solving not only free-flying manipulation problems but also attitude-control problems. The validity of the method is demonstrated by computer simulations with a realistic model of a robot satellite.

A89-43024 SPACE COLORISTICS

VLADIMIR V. VASIUTIN (Akademiia Voenno-Vozdushnykh Sil, Moscow, USSR) and ARTUR A. TISHCHENKO (Nauchno-Proizvodstvennoe Ob'edinenie Priroda, Moscow, USSR) Scientific American (ISSN 0036-8733), vol. 261, July 1989, p. 84-90.

Studies to determine the colors of natural formations and phenomena on the earth as seen from outer space are reviewed. An atlas consisting of samples of 1,000 colors observed from space has been compiled using observations from the Salyut orbital station. Consideration is given to the development of a portable visual colorimeter based on a single-lens-reflex camera and an automatic photoelectric colorimeter for use in space. In addition, studies of the characteristics of human color vision during long space flights are examined.

A89-43074#

THE HERMES ROBOT ARM [HERMES ROBOT ARM]

D. F. KUIPER (Fokker Space and Systems, Amsterdam, Netherlands) Ruimtevaart, vol. 38, April 1989, p. 20-30. In Dutch.

The design concept, applications, and present status of the Hermes Robot Arm (Hera), a telemanipulator system being developed for use with the ESA space shuttle Hermes, are discussed and illustrated with extensive drawings and diagrams. A general overview of the roles of Hermes and the MTFF in the International Space Station scenario is given, and the use of Hera to handle orbit-replaceable units, manipulate large structural components, or serve as a mobile platform for astronauts during EVAs is described. Particular attention is given to the functions of Hera during Hermes servicing of the MTFF; the Hera arm structure, end-effector, control system, and simulation and test facilities; and the organization of the Hera R&D program. Specific engineering goals for the immediate future are outlined.

A89-43141 TELEROBOTICS SYSTEM SIMULATION FOR SPACE APPLICATIONS

SHOU X ZHANG (Northwestern Polytechnical University, Xian, People's Republic of China), FAN T. TSENG, and BERNARD J. SCHROER (Alabama, University, Huntsville) IN: 1988 Annual Summer Computer Simulation Conference, 20th, Seattle, WA, July 25-28, 1988, Proceedings. San Diego, CA, Society for Computer Simulation International, 1988, p. 713-718. Research supported by Alabama Research Institute and Alabama Dept. of Economic and Community Affaires. refs

The development of a telerobotics laboratory for studying man's role in space telerobotics is discussed. The laboratory is configured around a Puma 562 6 DOF arm. A high-resolution black and white CCD camera is mounted on the arm. The following basic tasks were identified for space servicing, structure assembling, and contingencies: (1) the operation of mechanical connections, electrical connections, and latching devices, (2) the grasping and positioning of objects, and (3) the operation of cutting and welding devices.

N89-23904*# National Aeronautics and Space Administration.

Marshall Space Flight Center, Huntsville, AL.

ASTRONAUT TOOL DEVELOPMENT: AN ORBITAL REPLACEABLE UNIT-PORTABLE HANDHOLD

JOHN W. REDMON, JR. In its The 23rd Aerospace Mechanisms Symposium p 181-193 Mar. 1989 Avail: NTIS HC A15/MF A01 CSCL 05H A tool to be used during astronaut Extra-Vehicular Activity (EVA) replacement of spent or defective electrical/electronic component boxes is described. The generation of requirements and design philosophies are detailed, as well as specifics relating to mechanical development, interface verifications, testing, and astronaut feedback. Findings are presented in the form of: (1) a design which is universally applicable to spacecraft component replacement, and (2) guidelines that the designer of orbital replacement units might incorporate to enhance spacecraft on-orbit maintainability and EVA mission safety.

N89-24043# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics Computer Science.

DIRECT MANIPULATION AND OTHER STYLES OF MAN-MACHINE INTERACTION

J. M. VERSENDAAL 1988 20 p

(PB89-146070; REPT-88-53) Avail: NTIS HC A03/MF A01 CSCL 05/8

As new technologies are used in computer hardware, such as fast refresh graphics screens, and as people began to realize that common computer interaction could be difficult, a new and, to the user often a more comprehensible computer dialogue style has emerged. Using that dialogue style, users interact with the computer system by directly manipulating the object of interest presented on the screen. Schneiderman called this new dialogue style Direct Manipulation (DM). A precise description of DM along with conventional dialogue styles is given. DM interfaces often cause unique problems, compared with other dialogue styles. These problems, their causes and possible ways of solving them are discussed.

N89-24044*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

SPACE STATION ECLSS SIMPLIFIED INTEGRATED TEST Final Report

RICHARD G. SCHUNK, ROBERT M. BAGDIGIAN, ROBYN L. CARRASQUILLO, KATHYRN Y. OGLE, and PAUL O. WIELAND Mar. 1989 42 p

(NASA-TM-100363; NAS 1.15:100363) Avail: NTIS HC A03/MF A01 CSCL 06/11

A discussion of the Space Station Simplified Integrated Test (SIT) was conducted. The first in a series of three integrated Environmental Control and Life Support (ECLS) system tests, the primary objectives of the SIT were to verify proper operation of ECLS subsystems functioning in an integrated fashion as well as to gather preliminary performance data for the partial ECLS system used in the test. A description of the SIT configuration, a summary of events, a discussion of anomalies that occurred during the test, and detailed results and analysis from individual measurements and water and gas samples taken during the test are included. The preprototype ECLS hardware used in the test is reported providing an overall process description and theory of operation for each hardware item.

N89-24045# Georgia Inst. of Tech., Atlanta. Center for Human-Machine Systems Research.

AN ICAI (INTELLIGENT COMPUTER AIDED INSTRUCTION) ARCHITECTURE FOR TROUBLESHOOTING IN COMPLEX DYNAMIC SYSTEMS

JANET L. FATH, CHRISTINE M. MITCHELL, and T. GOVINDARAJ Dec. 1988 62 p (Contract N00014-87-K-0482; RM3-3-M-20)

(AD-A205434; GIT-88-4) Avail: NTIS HC A04/MF A01 CSCL 23/2

AHAB is an architecture for simulator-based ICAI (Intelligent Computer Aided Instruction) programs to teach troubleshooting in complex, dynamic environments. The architecture posits three elements of a computerized instructor: The task model, the student model, and the instructional module. The task model is a prescriptive model of expert performance that uses symptomatic and topographic search strategies to provide students with directed problem-solving aids. The student model is a descriptive model of student performance in the context of task model. This student

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

model compares the student and task models, critiques student performance in the context of the task model. This student model compares the student and task models, critiques student performance, and provide interactive performance feedback. Finally, the instructional module coordinates information presented by the instructional media, the task model, and the student model so that each student receives individualized instruction. Concept and meta-concept knowledge that supports these elements is contained in frames and production rules, respectively.

N89-24046# Defence Research Establishment, Ottawa (Ontario). Protective Sciences Div.

THE CONCEPT AND THEORETICAL CONSIDERATIONS OF A COLD WEATHER CLOTHING SYSTEM

B. CAIN, B. FARNSWORTH, and R. OSCZEVSKI Dec. 1988 41 p

(AD-A205476; DREO-998) Avail: NTIS HC A03/MF A01 CSCL 05/8

The concept and theoretical considerations of a clothing system for cold weather is discussed. The temperature range of interest was -40 to 10 C which was divided into an extreme-cold temperature range (-40 to -10 C) and a cold-wet temperature range (-10 to 10 C). An essential goal of the clothing system was to provide adequate thermal insulation for metabolic rates between 150 and 600 W while a desirable goal was to provide adequate thermal insulation for metabolic rates up to 1000 W. The clothing differs from conventional clothing mainly in its doctrine of use as insulation is added to or removed from the outside. This makes the clothing more versatile and more easily used.

N89-24047# Center for Night Vision and Electro-Optics, Fort Belvoir, VA.
NIGHT VISION GOGGLES (AN/PVS-7) PERFORMANCE

ISSUES AND ANSWERS Final Report, 1986 - 1988 WALTER B. MORROW, JR. Mar. 1989 47 p (AD-A206117; AMSEL-NV-TR-0075) Avail: NTIS HC A03/MF A01 CSCL 17/5

During 1987, pursuant to a tasking by the Undersecretary of the Army through the institute for Defense Analysis, the U.S. Army CECOM Center for Night Vision and Electro-Optics (C2NVEO) carried out a comprehensive series of studies to characterize the spectral content of night sky irradiance across the spectral sensitivity bands of second and third generation AN/PVS-7 Night Vision Goggles. This effort was then logically extended to the development of a detailed comparative performance analysis of night vision goggles within the true spectral characterization of the night sky environment. Several related issues were also of concern to the Undersecretary, including the effect of various bandpass and notch spectral filters with goggles, and finally the operational life and reliability of night vision goggles.

N89-24048# Analytics, Inc., Willow Grove, PA. DESIGN OF A MANPRINT TOOL FOR PREDICTING PERSONNEL AND TRAINING CHARACTERISTICS IMPLIED BY SYSTEM DESIGN Final Report, Jun. 1987 - Jan. 1988 ALFRED O. DICK, ALVAH C. BITTNER, and REGINA HARRIS Jan. 1989 314 p

(Contract MDA903-86-C-0413)

(AD-A206201; ARI-RN-89-04) Avail: NTIS HC A14/MF A01 **CSCL 05/9**

This report describes the development and design specifications for a software-based aid for Army system designers. The purpose of the aid is to evaluate a system design by determining the operator and maintainer characteristics required by that design to reach criterion system performance levels. The aid is an analytical, simulation-based approach that will predict the impact on total system performance of individual differences in cognitive and psychomotor performance and of new system technologies. The specification describes a system based on the Human Operator Simulator (HOS) 4. In this approach, HOS performance micromodels are to be built from the Army Research Institute's (ARI) Project A predictor data. Although the design specification

described herein is not being developed any further by ARI, it may prove useful for other projects.

N89-24049# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.

HUMAN-MACHINE INTERACTION CONSIDERATIONS FOR INTERACTIVE SOFTWARE Final Technical Report

LEN BASS and JOELLE COUTAZ (Grenoble-1 Univ., France) Feb. 1989 117 p (Contract F19628-85-C-0003)

(AD-A206574; CMU/SEI-89-TR-4; ESD-TR-89-04) Avail: NTIS HC A06/MF A01 CSCL 23/2

This document introduces current concepts and techniques relevant to the design and implementation of user interfaces. A user interface refers to those aspects of a system that the user refers to, perceives, knows and understands. A user interface is implemented by code that mediates between a user and a system. This document covers both aspects. The first chapter is an introduction to the psychology of human-computer interaction. It presents the theoretical models that have had a significant impact on the evolution of the field. These models offer a way to organize the design process and help understand the cognitive process involved in interacting with a computer. The rest of the document is concerned with the software design of user interfaces and shows how the principles established by the cognitive principles can be put into practice. Following a presentation on the abstractions involved in the organization of an interactive system, attention is then directed to the tools for constructing user interfaces: windowing systems, tool kits and user interface management systems.

N89-24050# Aerospatiale, Paris (France).

THE ROLE OF PILOT AND AUTOMATIC ONBOARD SYSTEMS IN FUTURE RENDEZVOUS AND DOCKING OPERATIONS

W. FEHSE, A. TOBIAS, A. GETZSCHMANN, M. CALDICHOURY, P. MAUTE, and M. ATTANASIO (Aerospatiale, Cannes La Bocca, 1988 13 p Presented at the 39th International Astronautical Federation Congress, Bangalore, India, 8-15 Oct. 1988 Previously announced in IAA as A89-17642 (REPT-882-440-116; IAF-88-037; ETN-89-94509) Avail: NTIS

HC A03/MF A01

In the frame of a Hermes mission to service the Columbus module, an analysis of the role of pilots is presented. The discussion includes requirements, tasks to be performed onboard during rendezvous operations, the possibility of interaction by a pilot with an automatic guidance navigation and control system, and the necessary non-machine interfaces. Proposals for specific man machine interface displays and their arrangement in the cockpit are presented. The conclusion is that the pilot must have continuous access to all necessary information and must have the possibility to intervene at each point in time.

N89-24354# Dornier-Werke G.m.b.H., Friedrichshafen (Germany,

ECLS FOR COLUMBUS AND HERMES

H. PREISS, G. KRING, and R. SCHAEFER In ESA, International Symposium on Europe in Space: The Manned Space System p 163-167 Oct. 1988

Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC. Noordwijk, Netherlands, 80 Dutch guilders

The environment control and life support subsystems (ECLS) of Hermes and Columbus are presented. The Hermes ECLS system has to ensure adequate working conditions for three persons during a 12 day mission. It includes atmosphere, liquids, food/galley, and waste management subsystems. The Columbus ECLS supports scientific experiments in an unmanned mode for 180 days, plus 7 days servicing with 2 persons. The ECLS functions for Columbus are mainly concerned with atmosphere control and conditioning.

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54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

N89-24362# Elektronik-System G.m.b.H., Munich (Germany, F.R.)

MANNED INTERVENTIONS AT THE MTFF: CREW WORKLOAD ASPECTS

K. BRAMMER and GEORG KAMPFER (Panares, Munich, Germany, F.R.) In ESA, International Symposium on Europe in Space: The Manned Space System p 233-237 Oct. 1988

Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The scenario of a Hermes visit to a Columbus MTFF and requirements with respect to crew activities for tending the MTFF subsystems and payload were investigated. An intervention concept is derived using a medium degree of automation, with exceptions to cater for optimal workflow, and frequent and time consuming tasks. It is concluded that a 7 day servicing period is required, with most of the difficulties arising from external servicing. The need to make payloads servicing-friendly is stressed.

N89-24387# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

GETTING READY FOR EVA

A. ACCENSI *In its* International Symposium on Europe in Space: The Manned Space System p 467-475 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC,

Noordwijk, Netherlands, 80 Dutch guilders

The roles of astronauts and robots in space missions are discussed. The advantages of extravehicular activity (EVA) for complex and contingency tasks is considered. The history and status of EVA programs conducted by ESA are summarized.

ESA

N89-24388# Dornier-Werke G.m.b.H., Friedrichshafen (Germany, F.R.).

EVÁ INFORMATION SYSTEM: A MODERN WORKSTATION IN SPACE

FRANZ PITTERMANN, PIERRE LARROQUE, and STEPHANE BERTHIER (Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France) In ESA, International Symposium on Europe in Space: The Manned Space System p 477-483 Oct. 1988

Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Information and communication requirements for extravehicular activity (EVA) are identified. Man-machine interfaces for EVA are discussed, and the relative merits of astronauts and robots are compared. Technologies and techniques needed in an EVA workstation are considered, and it is argued that the required technologies exist and can be adapted to space conditions.

ESA

N89-24392# LABEN Space Instrumentation and Systems, Milan (Italy). Advanced Research and Development Dept.

ADVANCED MMI AND IMAGE HANDLING TO SUPPORT CREW ACTIVITIES

R. CORTINOVIS, B. BARNI, and R. PERSICO *In* ESA, International Symposium on Europe in Space: The Manned Space System p 509-514 Oct. 1988

Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

A concept for a crew workstation, focusing on man-machine interface (MMI) aspects related to the integrated handling of text, graphics, and visual information is presented. Window and overlay management methods, and image processing techniques for picture quality enhancement are discussed.

N89-24792*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.
HUMAN FACTORS IN AUTOMATED AND ROBOTIC SPACE SYSTEMS: PROCEEDINGS OF A SYMPOSIUM. PART 1
THOMAS B. SHERIDAN, ed., DANA S. KRUSER, ed., and STANLEY DEUTSCH, ed. 1987 475 p Symposium held in Washington, DC, 29-30 Jan. 1987

(Contract NASW-4071)

(NASA-CR-182495; NAS 1.26:182495) Avail: NTIS HC A20/MF A01 CSCL 05/8

Human factors research likely to produce results applicable to the development of a NASA space station is discussed. The particular sessions covered in Part 1 include: (1) system productivity -- people and machines; (2) expert systems and their use; (3) language and displays for human-computer communication; and (4) computer aided monitoring and decision making. Papers from each subject area are reproduced and the discussions from each area are summarized.

N89-24793*# McDonnell-Douglas Astronautics Co., Huntsville,

THE HUMAN ROLE IN SPACE (THURIS) APPLICATIONS STUDY. FINAL BRIEFING

GEORGE W. MAYBEE Oct. 1987 73 p (Contract NAS8-36638)

(NASA-CR-183590; NAS 1.26:183590; MDC-W5125-2) Avail: NTIS HC A04/MF A01 CSCL 05/8

The THURIS (The Human Role in Space) application is an iterative process involving successive assessments man/machine mixes in terms of performance, cost and technology to arrive at an optimum man/machine mode for the mission application. The process begins with user inputs which define the mission in terms of an event sequence and performance time requirements. The desired initial operational capability date is also an input requirement. THURIS terms and definitions (e.g., generic activities) are applied to the input data converting it into a form which can be analyzed using the THURIS cost model outputs. The cost model produces tabular and graphical outputs for determining the relative cost-effectiveness of a given man/machine mode and generic activity. A technology database is provided to enable assessment of support equipment availability for selected man/machine modes. If technology gaps exist for an application, the database contains information supportive of further investigation into the relevant technologies. The present study concentrated on testing and enhancing the THURIS cost model and subordinate data files and developing a technology database which interfaces directly with the user via technology readiness displays. This effort has resulted in a more powerful, easy-to-use applications system for optimization of man/machine roles. Volume 1 is an executive summary.

N89-24794*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.

HUMAN FACTORS IN AUTOMATED AND ROBOTIC SPACE SYSTEMS: PROCEEDINGS OF A SYMPOSIUM. PART 2

14 Aug. 1987 446 p Symposium held in Washington, DC, 29-30 Jan. 1987

(Contract NASW-4071)

(NASA-CR-182496; NÁS 1.26:182496) Avail: NTIS HC A19/MF A01 CSCL 05/8

Human factors research likely to produce results applicable to the development of a NASA space station is discussed. The particular sessions covered in Part 2 include: (1) computer aided monitoring and decision making; (2) telepresence and supervisory control; (3) social factors in productivity and performance; and (4) the human role in space systems. Papers from each subject area are reproduced and the discussions from each area are summarized.

A.D.

N89-24795*# McDonnell-Douglas Astronautics Co., Huntsville, AL.

THE HUMAN ROLE IN SPACE (THURIS) APPLICATIONS STUDY. VOLUME 2: RESEARCH ANALYSIS AND TECHNOLOGY REPORT

GEORGE W. MAYBEE Oct. 1987 273 p

(Contract NAS8-36638) (NASA-CR-183589; NAS 1.26:183589; MDC-W5141-2-VOL-2)

Avail: NTIS HC A12/MF A01 CSCL 05/8

The THURIS (The Human Role in Space) application is an iterative process involving successive assessments of man/

machine mixes in terms of performance, cost and technology to arrive at an optimum man/machine mode for the mission application. The process begins with user inputs which define the mission in terms of an event sequence and performance time requirements. The desired initial operational capability date is also an input requirement. THURIS terms and definitions (e.g., generic activities) are applied to the input data converting it into a form which can be analyzed using the THURIS cost model outputs. The cost model produces tabular and graphical outputs for determining the relative cost-effectiveness of a given man/machine mode and generic activity. A technology database is provided to enable assessment of support equipment availability for selected man/machine modes. If technology gaps exist for an application, the database contains information supportive of further investigation into the relevant technologies. The present study concentrated on testing and enhancing the THURIS cost model and subordinate data files and developing a technology database which interfaces directly with the user via technology readiness displays. This effort has resulted in a more powerful, easy-to-use applications system for optimization of man/machine roles. Volume 2 presents a summary of the study objectives, approach, and results and technical discussion of accomplishments in the principal study tasks of: (1) sensitivity analysis, and (2) technology readiness database development. A summary of the study conclusions and recommendations is also presented.

IBM Watson Research Center, Yorktown Heights, N89-24796#

EVALUATION, DESCRIPTION AND INVENTION: PARADIGMS FOR HUMAN-COMPUTER INTERACTION

JOHN M. CARROLL 16 Aug. 1988 25 p (AD-A204617) Avail: NTIS HC A03/MF A01 CSCL 23/2

Human-Computer Interaction (HCI) is an urgent and rapidly developing area of computer science research and application. As it continues to evolve and to define itself, it is possible to identify distinct paradigms, or orientations to HCI research and application. Initially, HCI work focussed on empirical laboratory evaluation of computer systems and techniques. Subsequently, empirical studies of usability were organized by and addressed to cognitive theoretical description of user behavior and experience. Currently, the focus of HCI work is shifting toward a more directive role in invention, design and development of systems and techniques. The progression of these three paradigms comprises a case study of a field discovering what it is about, and more generally, of the variety of roles available in the psychology of technology.

N89-24797*# Advanced Resource Development Corp., Columbia,

BRAIN-WAVE MEASURES OF WORKLOAD IN ADVANCED **COCKPITS: THE TRANSITION OF TECHNOLOGY FROM** LABORATORY TO COCKPIT SIMULATOR, PHASE 2 Final

RICHARD L. HORST, DAVID L. MAHAFFEY, and ROBERT C. MUNSON Washington NASA 1989 187 p (Contract NAS1-18019)

(NASA-CR-4240; NAS 1.26:4240) Avail: NTIS HC A09/MF A01 **CSCL 05/8**

The present Phase 2 small business innovation research study was designed to address issues related to scalp-recorded event-related potential (ERP) indices of mental workload and to transition this technology from the laboratory to cockpit simulator environments for use as a systems engineering tool. The project involved five main tasks: (1) Two laboratory studies confirmed the generality of the ERP indices of workload obtained in the Phase 1 study and revealed two additional ERP components related to workload. (2) A task analysis' of flight scenarios and pilot tasks in the Advanced Concepts Flight Simulator (ACFS) defined cockpit events (i.e., displays, messages, alarms) that would be expected to elicit ERPs related to workload. (3) Software was developed to support ERP data analysis. An existing ARD-proprietary package of ERP data analysis routines was upgraded, new graphics routines were developed to enhance interactive data analysis, and routines were developed to compare alternative single-trial analysis techniques using simulated ERP data. (4) Working in conjunction with NASA Langley research scientists and simulator engineers, preparations were made for an ACFS validation study of ERP measures of workload. (5) A design specification was developed for a general purpose, computerized, workload assessment system that can function in simulators such as the ACFS.

N89-24798*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

DISPLAY-BASED COMMUNICATIONS FOR ADVANCED TRANSPORT AIRCRAFT

ALFRED T. LEE May 1989 24 p

(NASA-TM-102187; A-89118; NAS 1.15:102187) Avail: NTIS HC A03/MF A01 CSCL 12/1

The next generation of civil transport aircraft will depend increasingly upon ground-air-ground and satellite data link for information critical to safe and efficient air transportation. Previous studies which examined the concept of display-based communications in addition to, or in lieu of, conventional voice transmissions are reviewed. A full-mission flight simulation comparing voice and display-based communication modes in an advanced transport aircraft is also described. The results indicate that a display-based mode of information transfer does not result in significantly increased aircrew workload, but does result in substantially increased message acknowledgment times when compared to conventional voice transmissions. User acceptance of the display-based communication system was generally high, replicating the findings of previous studies. However, most pilots tested expressed concern over the potential loss of information available from frequency monitoring which might result from the introduction of discrete address communications. Concern was expressed by some pilots for the reduced time available to search for conflicting traffic when using the communications display system. The implications of the findings for the design of display-based communications are discussed.

55

SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

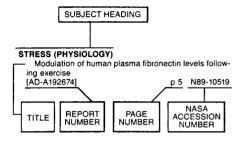
A89-43425 **EXTRATERRESTRIAL AMINO ACIDS IN** CRETACEOUS/TERTIARY BOUNDARY SEDIMENTS AT STEVNS KLINT, DENMARK

MEIXUN ZHAO and JEFFREY L. BADA (California, University, La Nature (ISSN 0028-0836), vol. 339, June 8, 1989, p. 463-465. Research supported by the University of California and U.S. Navv. refs

The K/T boundary sediments at Stevns Klint, Denmark, are found to contain both alpha-amino-isobutyric acid and racemic isovaline. These two amino acids are exceedingly rare on the earth but are major amino acids in carbonaceous chondrites. An extraterrestrial source is the most reasonable explanation for the presence of these amino acids.

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 328)

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

ABSORPTION SPECTROSCOPY

Non-destructive plant health sensing using absorption p 193 spectroscopy

ACCELERATION STRESSES (PHYSIOLOGY)

Observations on the neurophysiologic acceleration (+Gz) induced loss of consciousness p 196 A89-42159

ACCLIMATIZATION

A parametric study

Human adaptation to the Tibetan Plateau

[AD-A206463] p 198 N89-24031 **ACOUSTICS** The effects of blast trauma (impulse noise) on hearing

p 199 N89-24786

[AD-A206180]

ACTIVITY CYCLES (BIOLOGY)

Neurochemical control of circadian rhythms [AD-A206213]

p 199 N89-24788

ADAPTATION

Psychometric function reconstruction from adaptive tracking procedures

[AD-A205668] p 200 N89-24034 AEROSOLS

Oxygen, ozone, aerosols and ultraviolet extinction in p 191 A89-41017 geological times

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive summary and overview

[NASA-CP-10026-VOL-1] p 194 N89-2402?

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 2: Abstracts,

candidate experiments and feasibility study [NASA-CP-10026-VOL-2] p 194 p 194 N89-24023

AEROSPACE MEDICINE

Spectral analysis of vestibular nystagmus p 194 A89-40499

Cabin staff's perception of the impact of flying on their physical health p 200 A89-43323 Medical support for manned spaceflight

n 197 A89-43325 Man in Space - A survey of the medical literature

A89-43640 p 197 A strategy for space biology and medical science for the 1980s and 1990s

[NASA-CR-184895] p 197 N89-24024 Medical and radiation protection problems in space p 199 N89-24369

AIR TRANSPORTATION

Display-based communications for advanced transport aircraft

[NASA-TM-102187] p 207 N89-24798 AIRCRAFT PILOTS

Depth perception after prolonged usage of night vision p 196 A89-42157 goggles Fit to fly? Some common problems in otolaryngology p 196 A89-43324

ALGAE

Origin of the algae p 191 A89-40124 **ALTITUDE SICKNESS**

Human adaptation to the Tibetan Plateau

p 198 N89-24031 [AD-A206463] AMINES

Treatment with tyrosine, a neurotransmitter precursor, reduces environmental stress in humans

p 201 N89-24039 [AD-A2060351

AMINO ACIDS

Extraterrestrial amino acids in Cretaceous/Tertiary boundary sediments at Stevns Klint, Denmark

p 207 A89-43425

APTITUDE

Development and evaluation of integrating details: A complex spatial problem solving test n 201 N89-24035 [AD-A2058601

ARCHAEBACTERIA

Phylogenetic analysis based on rRNA sequences supports the archaebacterial rather than the eocyte tre p 191 A89-40125

ARCHITECTURE (COMPUTERS)

An ICAI (Intelligent Computer Aided Instruction) architecture for troubleshooting in complex dynamic

[AD-A205434] p 204 N89-24045

ASTRONAUT PERFORMANCE

Comparative study of astronaut motor behavior during ground training (g = 1) and during orbital flight (g = 0) p 194 A89-40825

The human role in space (THURIS) applications study. Final briefing [NASA-CR-183590] p 206 N89-24793

The human role in space (THURIS) applications study. Volume 2: Research analysis and technology report p 206 N89-24795 [NASA-CR-183589]

ASTRONAUT TRAINING

The training concept for ESA astronauts and the associated facilities p 202 N89-24374

The Hermes system training concept

p 202 N89-24375

Crew training aspects --- Hermes, Columbus p 202 N89-24396

ATTENTION

Relating attention to visual mechanisms [AD-A206452] p 202 N89-24042

AUDITORY DEFECTS

The effects of blast trauma (impulse noise) on hearing:

A parametric study [AD-A206180] p 199 N89-24786

AUTOMATIC CONTROL

Automated seed manipulation and planting p 193 N89-24017

В

BACTERIA

Structure and function of bacterial photosynthetic p 191 A89-40118 reaction centres Magnetofossil dissolution in a palaeomagnetically p 192 A89-41113 unstable deep-sea sediment

BED REST

Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise training p 195 A89-42152

BINOCULAR VISION

Depth perception after prolonged usage of night vision p 196 A89-42157

BIOASTRONAUTICS

A strategy for space biology and medical science for the 1980s and 1990s NASA-CR-1848951 p 197 N89-24024

BIOCHEMISTRY

Treatment with tyrosine, a neurotransmitter precursor. reduces environmental stress in humans

p 201 N89-24039 (AD-A2060351 **BIOLOGICAL EVOLUTION**

Origin of the algae p 191 A89-40124

BIOPHYSICS

Long term synaptic plasticity and learning in neuronal networks

[AD-A205993] p 201 N89-24038

BLOOD CIRCULATION

Human temperature regulation during exercise after oral pyridostigmine administration ÁD-A2060321 n 198 N89-24030

BLOOD COAGULATION

Coagulation and fibrinolysis in acute mountain sickness and beginning pulmonary edema p 194 A89-40851 BLOOD PRESSURE

Human adaptation to the Tibetan Plateau

[AD-A206463] p 198 N89-24031

BODY TEMPERATURE

Physiological and behavioral temperature regulation of men in simulated nonuniform thermal environments between 18 and 30 C p 195 A89-42155 Patterns of human drinking: Effects of exercise, water

temperature and food consumption [AD-A206031] p 198 N89-24029

BODY WEIGHT

Patterns of human drinking: Effects of exercise, water temperature and food consumption

[AD-A206031] p 198 N89-24029

BRAIN

Muramyl peptide-enhanced sleep: Pharmacological optimization of performance

[AD-A205974] p 197 N89-24028 Long term synaptic plasticity and learning in neuronal networks

[AD-A205993] p 201 N89-24038

BRAIN CIRCULATION Human adaptation to the Tibetan Plateau

[AD-A206463] p 198 N89-24031

C

CARBON DIOXIDE

Oxygen consumption rate of operational underwater swimmers

[AD-A205331] n 197 N89-24025 CARDIOVASCULAR SYSTEM Testing for irregularities of the cardiac rhythm and

conduction in flight personnel by means of a combined functional test p 196 A89-42439

Man in Space - A survey of the medical literature p 197 A89-43640

Neurochemical control of circadian rhythms (AD-A206213) p 199 N89-24788

CATARACTS Recovery of pupillomotor function after cataract

p 196 A89-42158 CATECHOLAMINE

Treatment with tyrosine, a neurotransmitter precursor, reduces environmental stress in humans p 201 N89-24039 [AD-A2060351

CELLS (BIOLOGY)

Free-electron lasers in ultraviolet photobiology

p 192 A89-41619

CENTRAL NERVOUS SYSTEM

intrinsic electrophysiological properties mammalian neurons - Insights into central nervous system function p 191 A89-40971

Evoked potential and other CNS reactions during a heliox	COMPUTER GRAPHICS	CULTURE TECHNIQUES
dive to 360 msw p 195 A89-42154	Monitoring information processing and decisions: The	Incubator for cell culturing under microgravity
CEREBRAL CORTEX Variation of cytoplasmic RNA in the rat's motor cortex	MOUSELAB system [AD-A205963] p 201 N89-24037	p 192 A89-43119
neurons and caudate nuclei due to hypokinesia	COMPUTER PROGRAMMING	Variation of cytoplasmic RNA in the rat's motor cortex
p 192 A89-42405	Evaluation, description and invention: Paradigms for	neurons and caudate nuclei due to hypokinesia
CHLOROPHYLLS Non-destructive plant health sensing using absorption	human-computer interaction [AD-A204617] p 207 N89-24796	p 192 A89-42405
spectroscopy p 193 N89-24021	COMPUTER PROGRAMS	D
CHOLINESTERASE	Human-machine interaction considerations for	D
Human temperature regulation during exercise after oral pyridostigmine administration	interactive software [AD-A206574] p 205 N89-24049	DATA PROCESSING
[AD-A206032] p 198 N89-24030	COMPUTER SYSTEMS DESIGN	Human adaptation to the Tibetan Plateau
CIRCADIAN RHYTHMS	Direct manipulation and other styles of man-machine	[AD-A206463] p 198 N89-24031 Monitoring information processing and decisions: The
Neurochemical control of circadian rhythms [AD-A206213] p 199 N89-24788	interaction [PB89-146070] p 204 N89-24043	MOUSELAB system
CLOSED ECOLOGICAL SYSTEMS	Human-machine interaction considerations for	[AD-A205963] p 201 N89-24037
Advanced space design program to the Universities	interactive software	DAYTIME The relationship between subjective and objective
Space Research Association and the National Aeronautics and Space Administration	[AD-A206574] p 205 N89-24049 COMPUTER TECHNIQUES	measures of sleepiness
[NASA-CR-180450] p 192 N89-24015	An ICAI (Intelligent Computer Aided Instruction)	[AD-A205861] p 197 N89-24027
Variable plant spacing p 193 N89-24016	architecture for troubleshooting in complex dynamic	DECISION MAKING Monitoring information processing and decisions: The
Automated seed manipulation and planting p 193 N89-24017	systems [AD-A205434] p 204 N89-24045	MOUSELAB system
Plant health sensing p 193 N89-24018	COMPUTERIZED SIMULATION	[AD-A205963] p 201 N89-24037
Automated seed manipulation and planting	Ergonomic design for perspective flight-path displays	DECONDITIONING Orthostatic responses following 30-day bed rest
p 193 N89-24020 Non-destructive plant health sensing using absorption	p 203 A89-42728 Resolved motion rate control of space manipulators with	deconditioning with isotonic and isokinetic exercise
spectroscopy p 193 N89-24021	generalized Jacobian matrix p 203 A89-42808	training p 195 A89-42152
Space station ECLSS simplified integrated test	Telerobotics system simulation for space applications	DEEP WATER Magnetofossil dissolution in a palaeomagnetically
[NASA-TM-100363] p 204 N89-24044 CLOTHING	p 204 A89-43141 Design of a MANPRINT tool for predicting personnel	unstable deep-sea sediment p 192 A89-41113
The concept and theoretical considerations of a cold	and training characteristics implied by system design	DEHYDRATION
weather clothing system	[AD-A206201] p 205 N89-24048	Solute model or cellular energy model: Practical and theoretical aspects of thirst during exercise
[AD-A205476] p 205 N89-24046	CONFERENCES	[AD-A206143] p 199 N89-24785
CLOUDS Gas-Grain Simulation Facility: Fundamental studies of	Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 1	Is salt at fault
particle formation and interactions. Volume 1: Executive	[NASA-CR-182495] p 206 N89-24792	[AD-A206518] p 199 N89-24789
summary and overview	Human Factors in Automated and Robotic Space	DETECTORS Plant health sensing p 193 N89-24018
[NASA-CP-10026-VOL-1] p 194 N89-24022 Gas-Grain Simulation Facility: Fundamental studies of	Systems: Proceedings of a symposium. Part 2 [NASA-CR-182496] p 206 N89-24794	DIETS
particle formation and interactions. Volume 2: Abstracts,	CONTOURS	Is salt at fault [AD-A206518] p 199 N89-24789
candidate experiments and feasibility study [NASA-CP-10026-VOL-2] p 194 N89-24023	The role of knowledge in visual shape representation	[AD-A206518] p 199 N89-24789 DISPLAY DEVICES
COCKPITS	[AD-A206173] p 202 N89-24041 CONTRAST	Ergonomic design for perspective flight-path displays
Cerebral laterality and handedness in aviation:	Field-dependence and judgment of weight and color	p 203 A89-42728
Performance and selection implications [AD-A206196] p 199 N89-24787	revisited: Some implications for the study of sensory	Display-based communications for advanced transport aircraft
[AD-A206196] p 199 N89-24787 COGNITION	discrimination [AD-A206141] p 203 N89-24791	[NASA-TM-102187] p 207 N89-24798
Development and evaluation of integrating details: A	CONTROL SYSTEMS DESIGN	DIVING (UNDERWATER)
complex spatial problem solving test	Space station ECLSS simplified integrated test	Evoked potential and other CNS reactions during a heliox dive to 360 msw p 195 A89-42154
[AD-A205860] p 201 N89-24035 The attention system of the human brain	(NASA-TM-100363) p 204 N89-24044 COSMIC DUST	Oxygen consumption rate of operational underwater
[AD-A206157] p 202 N89-24040	Gas-Grain Simulation Facility: Fundamental studies of	swimmers
Evaluation, description and invention: Paradigms for	particle formation and interactions. Volume 1: Executive	[AD-A205331] p 197 N89-24025 DRUGS
human-computer interaction [AD-A204617] p 207 N89-24796	summary and overview [NASA-CP-10026-VOL-1] p 194 N89-24022	Muramyl peptide-enhanced sleep: Pharmacological
COLD WEATHER	Gas-Grain Simulation Facility: Fundamental studies of	optimization of performance
The concept and theoretical considerations of a cold	particle formation and interactions. Volume 2: Abstracts,	[AD-A205974] p 197 N89-24028
weather clothing system [AD-A205476] p 205 N89-24046	candidate experiments and feasibility study [NASA-CP-10026-VOL-2] p 194 N89-24023	E
COLOR VISION	COST ANALYSIS	E
Space coloristics earth observations from orbital	The human role in space (THURIS) applications study.	EARTH OBSERVATIONS (FROM SPACE)
stations p 204 A89-43024 Quasi-monochromatic visual environments and the	Final briefing {NASA-CR-183590} p 206 N89-24793	Space coloristics earth observations from orbital
resting point of accommodation	The human role in space (THURIS) applications study.	stations p 204 A89-43024 EARTH SURFACE
[AD-A205938] p 201 N89-24036	Volume 2: Research analysis and technology report	Space coloristics earth observations from orbital
Field-dependence and judgment of weight and color revisited: Some implications for the study of sensory	[NASA-CR-183589] p 206 N89-24795 COST EFFECTIVENESS	stations p 204 A89-43024
discrimination	The human role in space (THURIS) applications study.	EDEMA Coagulation and fibrinolysis in acute mountain sickness
[AD-A206141] p 203 N89-24791	Final briefing	and beginning pulmonary edema p 194 A89-40851
COLUMBUS SPACE STATION Space robotics - Intra-vehicular operations	[NASA-CR-183590] p 206 N89-24793 The human role in space (THURIS) applications study.	EFFERENT NERVOUS SYSTEMS
p 203 A89-41457	Volume 2: Research analysis and technology report	Comparative study of astronaut motor behavior during ground training $(g = 1)$ and during orbital flight $(g = 0)$
ECLS for Columbus and Hermes p 205 N89-24354	[NASA-CR-183589] p 206 N89-24795	p 194 A89-40825
Manned interventions at the MTFF: Crew workload aspects p 206 N89-24362	CRETACEOUS-TERTIARY BOUNDARY	A low-energy X-ray irradiator for electrophysiological
aspects p 206 N89-24362 Crew training aspects Hermes, Columbus	Extraterrestrial amino acids in Cretaceous/Tertiary boundary sediments at Stevns Klint, Denmark	studies
p 202 N89-24396	p 207 A89-43425	[AD-A205388] p 197 N89-24026 ELECTROENCEPHALOGRAPHY
COMFORT	CREW PROCEDURES (INFLIGHT)	A low-energy X-ray irradiator for electrophysiological
Space station ECLSS simplified integrated test [NASA-TM-100363] p 204 N89-24044	Crew procedures and workload of retrofit concepts for microwave landing system	studies
COMPLEX SYSTEMS	[NASA-CR-181700] p 200 N89-24033	[AD-A205388] p 197 N89-24026
An ICAI (Intelligent Computer Aided Instruction)	Advanced MMI and image handling to support crew	ELECTROLYTES Patterns of human drinking: Effects of exercise, water
architecture for troubleshooting in complex dynamic	activities p 206 N89-24392 CREW WORKSTATIONS	temperature and food consumption
systems [AD-A205434] p 204 N89-24045	EVA Information System: A modern workstation in	[AD-A206031] p 198 N89-24029
COMPUTER AIDED DESIGN	space p 206 N89-24388	Is salt at fault
Design of a MANPRINT tool for predicting personnel and training characteristics implied by system design	Advanced MMI and image handling to support crew activities p 206 N89-24392	[AD-A206518] p 199 N89-24789 ELECTRON TRANSFER
[AD-A206201] p 205 N89-24048	activities p 206 N89-24392 CROP VIGOR	Structure and function of bacterial photosynthetic
COMPUTER ASSISTED INSTRUCTION	Advanced space design program to the Universities	reaction centres p 191 A89-40118
An ICAI (Intelligent Computer Aided Instruction)	Space Research Association and the National Aeronautics	ELECTROPHYSIOLOGY The intrinsic plantage in the least and the least are le
architecture for troubleshooting in complex dynamic	and Space Administration [NASA-CR-180450] p 192 N89-24015	The intrinsic electrophysiological properties of mammalian neurons - Insights into central nervous system
systems [AD-A205434] p 204 N89-24045	Plant health sensing p 193 N89-24018	function p 191 A89-40971
(· ···· · · · · · · · · · · · · · · · ·		,

A low-energy X-ray irradiator for	electrophysiological	FLIGHT FITNESS	GRAVITATIONAL PHYSIOLOGY
studies		The aviation medical examiner of the 1990s and	Comparative study of astronaut motor behavior during
[AD-A205388]	p 197 N89-24026	beyond p 196 A89-43322 Cabin staff's perception of the impact of flying on their	ground training (g = 1) and during orbital flight (g = 0) p 194 A89-40825
The attention system of the human (AD-A206157)	n brain p 202 N89-24040	physical health p 200 A89-43323	Observations on the neurophysiologic theory of
ENDOTOXINS	P 202 1100 24040	Fit to fly? Some common problems in otolaryngology	acceleration (+Gz) induced loss of consciousness
Muramyl peptide-enhanced sleep	: Pharmacological	p 196 A89-43324	p 196 A89-42159
optimization of performance	- 407 NOO 04000	Medical support for manned spaceflight p 197 A89-43325	GROUND BASED CONTROL
[AD-A205974]	p 197 N89-24028	FLIGHT PATHS	Display-based communications for advanced transport aircraft
ENVIRONMENTAL CONTROL Space station ECLSS simplified int	egrated test	Ergonomic design for perspective flight-path displays	[NASA-TM-102187] p 207 N89-24798
[NASA-TM-100363]	p 204 N89-24044	p 203 A89-42728 FLIGHT SAFETY	GROUND-AIR-GROUND COMMUNICATION
ECLS for Columbus and Hermes		Aircraft coordination training in the U.S. Air Force Air	Display-based communications for advanced transport
Neurochemical control of circadian		Training Command p 200 A89-42162	aircraft [NASA-TM-102187] p 207 N89-24798
[AD-A206213]	p 199 N89-24788	FLIGHT SIMULATION	GROUP DYNAMICS
ENVIRONMENTAL QUALITY Space station ECLSS simplified int	egrated test	Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit	Interpersonal and group-behavior skills training for crews
[NASA-TM-100363]	p 204 N89-24044	simulator, phase 2	on Space Station p 200 A89-42163
ERYTHROCYTES		[NASA-CR-4240] p 207 N89-24797	н
Human temperature regulation during	ng exercise after oral	Display-based communications for advanced transport aircraft	П
pyridostigmine administration [AD-A206032]	p 198 N89-24030	[NASA-TM-102187] p 207 N89-24798	HANDEDNESS
EUKARYOTES	F	FLIGHT SIMULATORS	Cerebral laterality and handedness in aviation:
Origin of the algae	p 191 A89-40124	Ergonomic design for perspective flight-path displays	Performance and selection implications
EUROPEAN SPACE PROGRAMS		p 203 A89-42728 FLIGHT SURGEONS	[AD-A206196] p 199 N89-24787 HAZARDS
The training concept for ESA a associated facilities	p 202 N89-24374	The aviation medical examiner of the 1990s and	The effects of blast trauma (impulse noise) on hearing:
EVALUATION	p 202 1103-24074	beyond p 196 A89-43322	A parametric study
The relationship between subject	tive and objective	FLIGHT TRAINING	[AD-A206180] p 199 N89-24786
measures of sleepiness		Aircraft coordination training in the U.S. Air Force Air Training Command p 200 A89-42162	HEARING The effects of blast trauma (impulse noise) on hearing:
[AD-A205861]	p 197 N89-24027	Interpersonal and group-behavior skills training for crews	A parametric study
EVOKED RESPONSE (PSYCHOPHYS Brain-wave measures of workload in	OLOGY)	on Space Station p 200 A89-42163	[AD-A206180] p 199 N89-24786
The transition of technology from Is		FOOD INTAKE Patterns of human drinking: Effects of exercise, water	HEART RATE
simulator, phase 2		temperature and food consumption	Operation Everest II - Maximal oxygen uptake at extreme altitude p 195 A89-40852
[NASA-CR-4240]	p 207 N89-24797	[AD-A206031] p 198 N89-24029	Testing for irregularities of the cardiac rhythm and
EXERCISE PHYSIOLOGY Is salt at fault		FOOD PRODUCTION (IN SPACE)	conduction in flight personnel by means of a combined
[AD-A206518]	p 199 N89-24789	Advanced space design program to the Universities Space Research Association and the National Aeronautics	functional test p 196 A89-42439 HEAT
EXOBIOLOGY	•	and Space Administration	Is salt at fault
Go forth and multiply? reproduc		[NASA-CR-180450] p 192 N89-24015	[AD-A206518] p 199 N89-24789
Formation and a mine poids in	p 192 A89-41851	Variable plant spacing p 193 N89-24016 Automated seed manipulation and planting	HELIUM-OXYGEN ATMOSPHERES
Extraterrestrial amino acids in boundary sediments at Stevns Klint,		p 193 N89-24017	Evoked potential and other CNS reactions during a heliox dive to 360 msw p 195 A89-42154
boarracky coamonic at every	p 207 A89-43425	Plant health sensing p 193 N89-24018	HERMES MANNED SPACEPLANE
A strategy for space biology and	medical science for	Automated seed manipulation and planting	The Hermes Robot Arm p 204 A89-43074
the 1980s and 1990s	- 107 NOO 04004	p 193 N89-24020 FOSSILS	The role of pilot and automatic onboard systems in future rendezvous and docking operations
[NASA-CR-184895] EXPLOSIONS	p 197 N89-24024	Magnetofossil dissolution in a palaeomagnetically	[REPT-882-440-116] p 205 N89-24050
The effects of blast trauma (impuls	se noise) on hearing:	unstable deep-sea sediment p 192 A89-41113	ECLS for Columbus and Hermes p 205 N89-24354
A parametric study	•	Proterozoic microfossils from manganese orebody, India p 192 A89-41860	Manned interventions at the MTFF: Crew workload
[AD-A206180]	p 199 N89-24786	India p 192 A89-41860 FREE ELECTRON LASERS	aspects p 206 N89-24362 The Hermes system training concept
EXPOSURE Additivity of retinal damage for n	nultinlo nulea lacar	Free-electron lasers in ultraviolet photobiology	p 202 N89-24375
exposures	iuitipie-puise iasei	p 192 A89-41619	Crew training aspects Hermes, Columbus
[AD-A206514]	p 198 N89-24032	^	p 202 N89-24396 HIGH ALTITUDE BREATHING
EXTINCTION	raviatot autination in	G	Operation Everest II - Maximal oxygen uptake at extreme
Oxygen, ozone, aerosols and ulti geological times	D 191 A89-41017	GENETIC CODE	altitude p 195 A89-40852
EXTRAVEHICULAR ACTIVITY	•	How old is the genetic code? Statistical geometry of	Human adaptation to the Tibetan Plateau [AD-A206463] p 198 N89-24031
Astronaut tool development: An		tRNA provides an answer p 191 A89-40924	HIGH ALTITUDE ENVIRONMENTS
unit-portable handhold Getting ready for EVA	p 204 N89-23904 p 206 N89-24387	GENETICS Phylogenetic analysis based on rRNA sequences	Coagulation and fibrinolysis in acute mountain sickness
EVA Information System: A mo		supports the archaebacterial rather than the eocyte tree	and beginning pulmonary edema p 194 A89-40851 HIPPOCAMPUS
space	p 206 N89-24388	p 191 A89-40125	A low-energy X-ray irradiator for electrophysiological
The human role in space (THURIS Final briefing	applications study.	GEOMETRY	studies
[NASA-CR-183590]	p 206 N89-24793	The role of knowledge in visual shape representation [AD-A206173] p 202 N89-24041	[AD-A205388] p 197 N89-24026
The human role in space (THURIS		GOGGLES	HUMAN BEHAVIOR Treatment with tyrosine, a neurotransmitter precursor,
Volume 2: Research analysis and tec		Depth perception after prolonged usage of night vision	reduces environmental stress in humans
[NASA-CR-183589]	p 206 N89-24795	goggles p 196 A89-42157 Night vision goggles (AN/PVS-7) performance issues	[AD-A206035] p 201 N89-24039
F		and answers	HUMAN BEINGS
Г		[AD-A206117] p 205 N89-24047	Operation Everest II - Adaptations in human skeletal muscle p 195 A89-40853
FLEXIBLE SPACECRAFT		GRAINS Con Conin Simulation Equilibra Fundamental studios of	Human adaptation to the Tibetan Plateau
A formulation for studying dynamics		Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive	[AD-A206463] p 198 N89-24031
based MRMS and its application	Mobile Remote p 203 A89-40811	summary and overview	The attention system of the human brain [AD-A206157] p 202 N89-24040
Manipulator System FLIGHT CONTROL	p 203 A09-40011	[NASA-CP-10026-VOL-1] p 194 N89-24022	HUMAN FACTORS ENGINEERING
Crew procedures and workload of	retrofit concepts for	Gas-Grain Simulation Facility: Fundamental studies of	Ergonomic design for perspective flight-path displays
microwave landing system	- 800 4400 04000	particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study	p 203 A89-42728 Cerebral laterality and handedness in aviation:
[NASA-CR-181700] FLIGHT CREWS	p 200 N89-24033	[NASA-CP-10026-VOL-2] p 194 N89-24023	Performance and selection implications
Aircraft coordination training in the	e U.S. Air Force Air	GRAINS (FOOD)	[AD-A206196] p 199 N89-24787
Training Command	p 200 A89-42162	Advanced space design program to the Universities Space Research Association and the National Aeronautics	Human Factors in Automated and Robotic Space
Testing for irregularities of the		and Space Administration	Systems: Proceedings of a symposium. Part 1 [NASA-CR-182495] p 206 N89-24792
conduction in flight personnel by m functional test	p 196 A89-42439	[NASA-CR-180450] p 192 N89-24015	Human Factors in Automated and Robotic Space
Cabin staff's perception of the imp	act of flying on their	GRAVITATIONAL EFFECTS	Systems: Proceedings of a symposium. Part 2
physical health	p 200 A89-43323	Gas-Grain Simulation Facility: Fundamental studies of	[NASA-CR-182496] p 206 N89-24794
Cerebral laterality and hander Performance and selection implication		particle formation and interactions. Volume 1: Executive summary and overview	Evaluation, description and invention: Paradigms for human-computer interaction
[AD-A206196]	p 199 N89-24787	[NASA-CP-10026-VOL-1] p 194 N89-24022	[AD-A204617] p 207 N89-24796

HUMAN PATHOLOGY

Spectral analysis of vestibular nystagmus

p 194 A89-40499 HUMAN PERFORMANCE

Physiological and behavioral temperature regulation of men in simulated nonuniform thermal environments between 18 and 30 C p 195 A89-42155

The relationship between subjective and objective measures of sleepiness

(AD-A205861)

p 197 N89-24027 Patterns of human drinking: Effects of exercise, water

temperature and food consumption

[AD-A206031] p 198 N89-24029

Psychometric function reconstruction from adaptive

tracking procedures [AD-A205668] p 200 N89-24034

Development and evaluation of integrating details: A complex spatial problem solving test

[AD-A205860] p 201 N89-24035 Human Factors in Automated and Robotic Space

Systems: Proceedings of a symposium. Part 1 [NASA-CR-182495] p 206 N89-24792

Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 2

p 206 N89-24794 (NASA-CR-182496) Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit

simulator, phase 2 (NASA-CR-42401

p 207 N89-24797

HYDROXYL RADICALS

Human temperature regulation during exercise after oral pyridostigmine administration

IAD-A2060321

p 198 N89-24030

HYPOBARIC ATMOSPHERES

Operation Everest II - Adaptations in human skeletal p 195 A89-40853

HYPOKINESIA

Variation of cytoplasmic RNA in the rat's motor cortex neurons and caudate nuclei due to hypokinesia

p 192 A89-42405

HYPOXIA

Operation Everest II - Maximal oxygen uptake at extreme p 195 A89-40852 altitude

Operation Everest II - Adaptations in human skeletal p 195 A89-40853

Human adaptation to the Tibetan Plateau

p 198 N89-24031 [AD-A206463]

Treatment with tyrosine, a neurotransmitter precursor. reduces environmental stress in humans [AD-A206035] p 201 N89-24039

IMAGE PROCESSING The role of knowledge in visual shape representation p 202 N89-24041 [AD-A206173]

Advanced MMI and image handling to support crew N89-24392 p 206 activities

IMAGES

Relating attention to visual mechanisms [AD-A206452]

p 202 N89-24042

INFECTIOUS DISEASES

Muramyl peptide-enhanced sleep: Pharmacological optimization of performance

p 197 N89-24028 (AD-A2059741

INFORMATION PROCESSING (BIOLOGY)

Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit simulator, phase 2

p 207 N89-24797 [NASA-CR-4240]

INFORMATION SYSTEMS

EVA Information System: A modern workstation in p 206 N89-24388 space

INTELLIGENCE

Development and evaluation of integrating details: A

complex spatial problem solving test p 201 N89-24035 [AD-A205860]

IRRADIANCE

Night vision goggles (AN/PVS-7) performance issues

[AD-A206117] p 205 N89-24047

IRREGULARITIES

Testing for irregularities of the cardiac rhythm and conduction in flight personnel by means of a combined p 196 A89-42439 functional test

JACOBI MATRIX METHOD

Resolved motion rate control of space manipulators with p 203 A89-42808 generalized Jacobian matrix

JUDGMENTS

Monitoring information processing and decisions: The MOUSELAB system

[AD-A205963] p 201 N89-24037

KNOWLEDGE REPRESENTATION

The role of knowledge in visual shape representation p 202 N89-24041 [AD-A206173]

LASER DAMAGE

Additivity of retinal damage for multiple-pulse laser exposures

IAD-A2065141 p 198 N89-24032

LASER OUTPUTS

Additivity of retinal damage for multiple-pulse laser exposures

(AD-A2065141

LEARNING Triazolam impairs learning and fails to improve sleep

p 200 A89-42160 in a long-range aerial deployment Long term synaptic plasticity and learning in neuronal networks

[AD-A2059931

p 201 N89-24038

p 198 N89-24032

LIFE SCIENCES

Go forth and multiply? --- reproduction in space p 192 A89-41851

LIFE SUPPORT SYSTEMS

incubator for cell culturing under microgravity p 192 A89-43119

ECLS for Columbus and Hermes p 205 N89-24354 LOCOMOTION Comparative study of astronaut motor behavior during

ground training (g = 1) and during orbital flight (g = 0)p 194 A89-40825

LOW TEMPERATURE

The concept and theoretical considerations of a cold weather clothing system

p 205 N89-24046 LOW TEMPERATURE ENVIRONMENTS

Treatment with tyrosine, a neurotransmitter precursor,

reduces environmental stress in humans p 201 N89-24039 [AD-A206035]

M

MAN MACHINE SYSTEMS

Telerobotics system simulation for space applications p 204 A89-43141 Direct manipulation and other styles of man-machine

[PB89-146070] p 204 N89-24043

The role of pilot and automatic onboard systems in future rendezvous and docking operations

[REPT-882-440-116] p 205 N89-24050 Getting ready for EVA p 206 N89-24387 Advanced MMI and image handling to support crew p 206 N89-24392 activities

Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 1 [NASA-CR-182495] p 206 N89-24792

The human role in space (THURIS) applications study.

[NASA-CR-183590] p 206 N89-24793 Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 2

[NASA-CR-182496] p 206 N89-24794 The human role in space (THURIS) applications study. Volume 2: Research analysis and technology report p 206 N89-24795 [NASA-CR-183589]

Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit simulator, phase 2

INASA-CR-42401 p 207 N89-24797

MAN-COMPUTER INTERFACE

Direct manipulation and other styles of man-machine interaction

[PB89-146070] p 204 N89-24043 Human-machine interaction considerations interactive software

[AD-A2065741 n 205 N89-24049 Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 1

(NASA-CR-1824951) p 206 N89-24792 Human Factors in Automated and Robotic Space

Systems: Proceedings of a symposium. Part 2 [NASA-CR-182496] p 206 N89-24794

Evaluation, description and invention: Paradigms for human-computer interaction p 207 N89-24796 LAD-A2046171

MANGANESE OXIDES

Proterozoic microfossils from manganese orebody, India p 192 A89-41860

MANIPULATORS

Resolved motion rate control of space manipulators with generalized Jacobian matrix p 203 A89-42808 p 204 A89-43074 The Hermes Robot Arm Automated seed manipulation and planting

p 193 N89-24020

MANNED SPACE FLIGHT

Go forth and multiply? --- reproduction in space p 192 A89-41851

Medical support for manned spaceflight p 197 A89-43325

Man in Space - A survey of the medical literature p 197 A89-43640

MARINE ENVIRONMENTS value of polarographic

measurements of tissue-oxygen pressure in evaluating functional state of p 196 A89-42440 seamen

MATERIALS HANDLING

Automated seed manipulation and planting p 193 N89-24017 Automated seed manipulation and planting

N89-24020

MECHANICAL DEVICES

Astronaut tool development: An orbital replaceable unit-portable handhold p 204 N89-23904

MEDICAL SCIENCE

A strategy for space biology and medical science for the 1980s and 1990s

[NASA-CR-184895]

p 197 N89-24024

p 201 N89-24037

MEMORY

Triazolam impairs learning and fails to improve sleep in a long-range aerial deployment p 200 A89-42160 Long term synaptic plasticity and learning in neuronal networks

[AD-A205993] p 201 N89-24038

MENTAL PERFORMANCE

The attention system of the human brain [AD-A206157]

p 202 N89-24040 Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit simulator, phase 2

[NASA-CR-4240] p 207 N89-24797

METABOLISM

Physiological and behavioral temperature regulation of men in simulated nonuniform thermal environments between 18 and 30 C p 195 A89-42155

METEORITE COLLISIONS

Extraterrestrial amino acids in Cretaceous/Tertiary boundary sediments at Stevns Klint, Denmark p 207 A89-43425

MICROCOMPUTERS

Monitoring information processing and decisions: The MOUSELAB system

[AD-A205963] MICROORGANISMS

Proterozoic microfossils from manganese orebody, India p 192 A89-41860

MICROWAVE LANDING SYSTEMS

Crew procedures and workload of retrofit concepts for microwave landing system INASA-CR-1817001 p 200 N89-24033

MILITARY OPERATIONS

Triazolam impairs learning and fails to improve sleep in a long-range aerial deployment p 200 A89-42160 Design of a MANPRINT tool for predicting personnel and training characteristics implied by system design [AD-A206201] p 205 N89-24048

MISSION PLANNING

Getting ready for EVA p 206 N89-24387 **MOLECULAR ABSORPTION**

Free-electron lasers in ultraviolet photobiology

p 192 A89-41619 MOLECULAR BIOLOGY

Free-electron lasers in ultraviolet photobiology

MONITORS Plant health sensing p 193 N89-24018 Non-destructive plant health sensing using absorption pectroscopy p 193 N89-24021

spectroscopy Monitoring information processing and decisions: The MOUSELAB system

[AD-A205963] MOTION SICKNESS

Adaptation to vection-induced symptoms motion sickness p 195 A89-42156

MUSCULOSKELETAL SYSTEM

Operation Everest II - Adaptations in human skeletal p 195 A89-40853 Man in Space - A survey of the medical literature

p 197 A89-43640

p 192 A89-41619

p 201 N89-24037

SUBJECT INDEX **PSYCHOMETRICS**

N

NERVOUS SYSTEM

Field-dependence and judgment of weight and color revisited: Some implications for the study of sensory discrimination

p 203 N89-24791 [AD-A206141]

NEUROLOGY

The intrinsic electrophysiological properties of mammalian neurons - Insights into central nervous system p 191 A89-40971 function

Cerebral laterality and handedness in aviation: Performance and selection implications

p 199 N89-24787 IAD-A2061961

NEUROMUSCULAR TRANSMISSION

Treatment with tyrosine, a neurotransmitter precursor, educes environmental stress in humans

p 201 N89-24039 [AD-A206035]

NEURONS

The intrinsic electrophysiological properties of mammalian neurons - Insights into central nervous system p 191 A89-40971 function Variation of cytoplasmic RNA in the rat's motor cortex

neurons and caudate nuclei due to hypokinesia p 192 A89-42405

A low-energy X-ray irradiator for electrophysiological studies

[AD-A205388] p 197 N89-24026

NEUROPHYSIOLOGY

Evoked potential and other CNS reactions during a helion dive to 360 msw p 195 A89-42154 Observations on the neurophysiologic theory of acceleration (+Gz) induced loss of consciousness

p 196 A89-42159 Long term synaptic plasticity and learning in neuronal

networks [AD-A205993] p 201 N89-24038

NEUROTRANSMITTERS

Treatment with tyrosine, a neurotransmitter precursor, reduces environmental stress in humans

p 201 N89-24039

NIGHT SKY

Night vision goggles (AN/PVS-7) performance issues

and answers p 205 N89-24047

[AD-A206117] **NIGHT VISION**

Depth perception after prolonged usage of night vision p 196 A89-42157 goggles Night vision goggles (AN/PVS-7) performance issues

[AD-A206117]

p 205 N89-24047

NUCLEATION

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive summary and overview p 194 N89-24022

[NASA-CP-10026-VOL-1] NYSTAGMUS

Dependence of optokinetic nystagmus on the width of p 194 A89-40498 the vision field

0

OCEAN BOTTOM

Magnetofossil dissolution in a palaeomagnetically unstable deep-sea sediment
ON-LINE SYSTEMS p 192 A89-41113

An ICAI (Intelligent Computer Aided Instruction) architecture for troubleshooting in complex dynamic systems p 204 N89-24045

AD-A2054341 OPERATOR PERFORMANCE

Design of a MANPRINT tool for predicting personnel and training characteristics implied by system design p 205 N89-24048 [AD-A206201]

OPHTHALMOLOGY Recovery of pupillomotor function after cataract p 196 A89-42158

OPTICAL COMMUNICATION

Display-based communications for advanced transport aircraft

[NASA-TM-102187] p 207 N89-24798

OPTIMIZATION The human role in space (THURIS) applications study.

Final briefing [NASA-CR-183590] p 206 N89-24793 The human role in space (THURIS) applications study.

Volume 2: Research analysis and technology report [NASA-CR-183589] p 206 N89-24795

ORBITAL SERVICING

Manned interventions at the MTFF: Crew workload p 206 N89-24362 aspects The human role in space (THURIS) applications study.

Final briefing [NASA-CR-183590] p 206 N89-24793

The human role in space (THURIS) applications study. Volume 2: Research analysis and technology report [NASA-CR-183589] p 206 N89-24795

ORBITAL WORKERS

The human role in space (THURIS) applications study.

Final briefing [NASA-CR-183590] p 206 N89-24793

The human role in space (THURIS) applications study.

Volume 2: Research analysis and technology report NASA-CR-183589] p 206 N89-24795

ORGANELLES

RNA-protein interactions in 30S ribosomal subunits -Folding and function of 16S rRNA p 191 A89-40877 ORTHOSTATIC TOLERANCE

Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise training p 195 A89-42152

OTOLARYNGOLOGY

Fit to fly? Some common problems in otolaryngology p 196 A89-43324

Oxygen, ozone, aerosols and ultraviolet extinction in geological times p 191 A89-41017

OXYGEN CONSUMPTION

Oxygen consumption rate of operational underwater swimmers

AD-A2053311 OXYGEN TENSION

p 197 N89-24025

The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen p 196 A89-42440

Oxygen, ozone, aerosols and ultraviolet extinction in geological times p 191 A89-41017

PALEOBIOLOGY

Proterozoic microfossils from manganese orebody p 192 A89-41860 India

PALEOMAGNETISM

Magnetofossil dissolution in a palaeomagnetically unstable deep-sea sediment p 192 A89-41113

PALEONTOLOGY Extraterrestrial amino acids in Cretaceous/Tertiary boundary sediments at Stevns Klint, Denmark

p 207 A89-43425

PARTICLE INTERACTIONS Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive

summary and overview [NASA-CP-10026-VOL-1] p 194 N89-24022

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study p 194 N89-24023

NASA-CP-10026-VOL-2] **PARTICLES**

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive summary and overview

[NASA-CP-10026-VOL-1] p 194 N89-24022 Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 2: Abstracts,

candidate experiments and feasibility study [NASA-CP-10026-VOL-2] p 19 p 194 N89-24023

PARTICULATES

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive

summary and overview INASA-CP-10026-VOL-11 p 194 N89-24022 Gas-Grain Simulation Facility: Fundamental studies of

particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study p 194 N89-24023

[NASA-CP-10026-VOL-2] PATTERN RECOGNITION

The role of knowledge in visual shape representation [AD-A206173] p 202 N89-24041

Muramyl peptide-enhanced sleep: Pharmacological optimization of performance

[AD-A205974] p 197 N89-24028 PERCEPTION

Relating attention to visual mechanisms

p 202 N89-24042 [AD-A206452] Cerebral laterality and handedness in aviation: Performance and selection implications p 199 N89-24787 [AD-A206196]

PERSONALITY

Cerebral laterality and handedness in aviation: Performance and selection implications p 199 N89-24787 [AD-A206196]

PERSONNEL

The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of p 196 A89-42440

PERSONNEL SELECTION

Medical support for manned spaceflight

p 197 A89-43325

PHARMACOLOGY Triazolam impairs learning and fails to improve sleep in a long-range aerial deployment p 200 A89-42160

PHOTOSYNTHESIS

Structure and function of bacterial photosynthetic reaction centres p 191 A89-40118

PHYSICAL EXERCISE

Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise p 195 A89-42152 training

Patterns of human drinking: Effects of exercise, water temperature and food consumption [AD-A206031] p 198 N89-24029

Solute model or cellular energy model: Practical and theoretical aspects of thirst during exercise

p 199 N89-24785 [AD-A206143]

PHYSICIANS

The aviation medical examiner of the 1990s and p 196 A89-43322 beyond

PHYSIOLOGICAL EFFECTS

Solute model or cellular energy model: Practical and theoretical aspects of thirst during exercise [AD-A206143] p 199 N89-24785

PHYSIOLOGICAL RESPONSES

Man in Space - A survey of the medical literature

p 197 A89-43640

Neurochemical control of circadian rhythms p 199 N89-24788

PILOT PERFORMANCE

The role of pilot and automatic onboard systems in future rendezvous and docking operations

[REPT-882-440-116] p 205 N89-24050

PILOT SELECTION

Cerebral laterality and handedness in aviation: Performance and selection implications

[AD-A206196]

p 199 N89-24787 PILOT TRAINING

Aircraft coordination training in the U.S. Air Force Air Training Command p 200 A89-42162

The Hermes system training concept p 202 N89-24375 Cerebral laterality and handedness in aviation:

Performance and selection implications [AD-A206196] p 199 N89-24787

PLANTS (BOTANY)

Plant health sensing p 193 N89-24018 Non-destructive plant health sensing using absorption p 193 N89-24021

spectroscopy

Coagulation and fibrinolysis in acute mountain sickness and beginning pulmonary edema p 194 A89-40851

POLAROGRAPHY The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of p 196 A89-42440

POTABLE WATER

Patterns of human drinking: Effects of exercise, water temperature and food consumption p 198 N89-24029

(AD-A2060311 POTASSIUM

is salt at fault

[AD-A206518] p 199 N89-24789

PROBLEM SOLVING Development and evaluation of integrating details: A complex spatial problem solving test

[AD-A205860] p 201 N89-24035 An ICAI (Intelligent Computer Aided Instruction) architecture for troubleshooting in complex dynamic

[AD-A205434]

PROTECTIVE CLOTHING The concept and theoretical considerations of a cold

weather clothing system [AD-A205476] p 205 N89-24046

PROTEIN SYNTHESIS

RNA-protein interactions in 30S ribosomal subunits -Folding and function of 16S rRNA p 191 A89-40877 PSYCHOLOGICAL TESTS

Design of a MANPRINT tool for predicting personnel and training characteristics implied by system design [AD-A206201] p 205 N89-24048

PSYCHOLOGY

The attention system of the human brain [AD-A206157] p 202 N89-24040 Evaluation, description and invention: Paradigms for human-computer interaction

[AD-A2046171

p 207 N89-24796 PSYCHOMETRICS

Psychometric function reconstruction from adaptive tracking procedures [AD-A205668]

p 200 N89-24034

p 204 N89-24045

p 205 N89-24047

PSYCHOMOTOR PERFORMANCE

Development and evaluation of integrating details: A	Variation of cytoplasmic RNA in the rat's motor cortex neurons and caudate nuclei due to hypokinesia	Crew training aspects Hermes, Columbus
complex spatial problem solving test [AD-A205860] p 201 N89-24035	p 192 A89-42405	SPACE LABORATORIES
PSYCHOMOTOR PERFORMANCE	ROBOTICS	Space robotics - Intra-vehicular operations
Psychometric function reconstruction from adaptive	Space robotics - Intra-vehicular operations	p 203 A89-4145 Gas-Grain Simulation Facility: Fundamental studies of
tracking procedures [AD-A205668] p 200 N89-24034	p 203 A89-41457 Resolved motion rate control of space manipulators with	particle formation and interactions. Volume 1: Executive
Design of a MANPRINT tool for predicting personnel	generalized Jacobian matrix p 203 A89-42808	summary and overview
and training characteristics implied by system design	Telerobotics system simulation for space applications	[NASA-CP-10026-VOL-1] p 194 N89-2402 SPACE MAINTENANCE
[AD-A206201] p 205 N89-24048 PSYCHOPHYSICS	p 204 A89-43141	Astronaut tool development: An orbital replaceable
Psychometric function reconstruction from adaptive	Human Factors in Automated and Robotic Space	unit-portable handhold p 204 N89-2390
tracking procedures	Systems: Proceedings of a symposium. Part 1 [NASA-CR-182495] p 206 N89-24792	The human role in space (THURIS) applications study
[AD-A205668] p 200 N89-24034 PSYCHOPHYSIOLOGY	Human Factors in Automated and Robotic Space	Final briefing [NASA-CR-183590] p 206 N89-2479
Psychometric function reconstruction from adaptive	Systems: Proceedings of a symposium. Part 2	The human role in space (THURIS) applications study
tracking procedures	[NASA-CR-182496] p 206 N89-24794	Volume 2: Research analysis and technology report
[AD-A205668] p 200 N89-24034	ROBOTS The Hermes Robot Arm p 204 A89-43074	[NASA-CR-183589] p 206 N89-2479
Field-dependence and judgment of weight and color	The Hermes Robot Arm p 204 A89-43074 Getting ready for EVA p 206 N89-24387	SPACE PLATFORMS A formulation for studying dynamics of the Space Statio
revisited: Some implications for the study of sensory discrimination	The human role in space (THURIS) applications study.	based MRMS and its application Mobile Remot
[AD-A206141] p 203 N89-24791	Final briefing	Manipulator System p 203 A89-4081
PULMONARY LESIONS	[NASA-CR-183590] p 206 N89-24793	SPACE PSYCHOLOGY
Coagulation and fibrinolysis in acute mountain sickness and beginning pulmonary edema p 194 A89-40851	The human role in space (THURIS) applications study.	Interpersonal and group-behavior skills training for crew on Space Station p 200 A89-4216
PUPILS	Volume 2: Research analysis and technology report [NASA-CR-183589] p 206 N89-24795	SPACE STATION PAYLOADS
Recovery of pupillomotor function after cataract	ROTATING ENVIRONMENTS	Gas-Grain Simulation Facility: Fundamental studies of
surgery p 196 A89-42158	Adaptation to vection-induced symptoms motion	particle formation and interactions. Volume 1: Executive
_	sickness p 195 A89-42156	summary and overview
R	_	[NASA-CP-10026-VOL-1] p 194 N89-2402. SPACE STATIONS
	S	A formulation for studying dynamics of the Space Station
RADIATION EFFECTS A low-energy X-ray irradiator for electrophysiological		based MRMS and its application Mobile Remot
studies	SATELLITE ATTITUDE CONTROL Resolved motion rate control of space manipulators with	Manipulator System p 203 A89-4081
[AD-A205388] p 197 N89-24026	generalized Jacobian matrix p 203 A89-42808	Interpersonal and group-behavior skills training for crew on Space Station p 200 A89-4216
RADIATION PROTECTION	SEDIMENTS	Telerobotics system simulation for space applications
Medical and radiation protection problems in space p 199 N89-24369	Magnetofossil dissolution in a palaeomagnetically	p 204 A89-4314
REACTION KINETICS	unstable deep-sea sediment p 192 A89-41113 Extraterrestrial amino acids in Cretaceous/Tertiary	Human Factors in Automated and Robotic Space
Structure and function of bacterial photosynthetic	boundary sediments at Stevns Klint, Denmark	Systems: Proceedings of a symposium. Part 1
reaction centres p 191 A89-40118	p 207 A89-43425	[NASA-CR-162495] p 206 N89-2479
REACTION TIME	SEEDS	Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 2
The relationship between subjective and objective measures of sleepiness	Automated seed manipulation and planting p 193 N89-24017	[NASA-CR-182496] p 206 N89-24794
[AD-A205861] p 197 N89-24027	Automated seed manipulation and planting	SPACE TOOLS
RECOGNITION	p 193 N89-24020	Space robotics - Intra-vehicular operations
Relating attention to visual mechanisms	SEMANTICS	p 203 A89-4145
[AD-A206452] p 202 N89-24042	Relating attention to visual mechanisms [AD-A206452] p 202 N89-24042	. Astronaut tool development: An orbital replaceable unit-portable handhold p 204 N89-23904
REDUCED GRAVITY	SENSORY DISCRIMINATION	SPACEBORNE EXPERIMENTS
Incubator for cell culturing under microgravity p 192 A89-43119	Field-dependence and judgment of weight and color	Gas-Grain Simulation Facility: Fundamental studies of
Advanced space design program to the Universities	revisited: Some implications for the study of sensory	particle formation and interactions. Volume 1: Executive
Space Research Association and the National Aeronautics	discrimination [AD-A206141] p 203 N89-24791	summary and overview [NASA-CP-10026-VOL-1] p 194 N89-2402:
and Space Administration [NASA-CR-180450] p 192 N89-24015	SENSORY PERCEPTION	Gas-Grain Simulation Facility: Fundamental studies of
[NASA-CR-180450] p 192 N89-24015 Gas-Grain Simulation Facility: Fundamental studies of	The attention system of the human brain	particle formation and interactions. Volume 2: Abstracts
particle formation and interactions. Volume 1: Executive	[AD-A206157] p 202 N89-24040 SEPARATORS	candidate experiments and feasibility study
summary and overview	Automated seed manipulation and planting	[NASA-CP-10026-VOL-2] p 194 N89-2402
[NASA-CP-10026-VOL-1] p 194 N89-24022	p 193 N89-24020	SPACECRAFT CONTROL Space robotics - Intra-vehicular operations
Gas-Grain Simulation Facility: Fundamental studies of	SHAPES	p 203 A89-4145
particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study	The effects of window shape and reticle presence on performance in a vertical alignment task	SPACECRAFT DESIGN
[NASA-CP-10026-VOL-2] p 194 N89-24023	p 203 A89-42153	The role of pilot and automatic onboard systems in future
REGULATORY MECHANISMS (BIOLOGY)	SHOCK RESISTANCE	rendezvous and docking operations
Physiological and behavioral temperature regulation of	A method of isolating treadmill shock and vibration on	[REPT-882-440-116] p 205 N89-2405i A method of isolating treadmill shock and vibration or
men in simulated nonuniform thermal environments between 18 and 30 C p 195 A89-42155	spacecraft [NASA-TM-100474] p 200 N89-24790	spacecraft
REMOTE MANIPULATOR SYSTEM	SIMULATORS	[NASA-TM-100474] p 200 N89-24790
A formulation for studying dynamics of the Space Station	The effects of blast trauma (impulse noise) on hearing:	SPACECRAFT ENVIRONMENTS
based MRMS and its application Mobile Remote	A parametric study	Space station ECLSS simplified integrated test [NASA-TM-100363] p 204 N89-2404
Manipulator System p 203 A89-40811	[AD-A206180] p 199 N89-24786 SLEEP	Medical and radiation protection problems in space
Space coloristics earth observations from orbital	Triazolam impairs learning and fails to improve sleep	p 199 N89-2436
stations p 204 A89-43024	in a long-range aerial deployment p 200 A89-42160	SPACECRAFT TEMPERATURE
REPRODUCTION (BIOLOGY)	The relationship between subjective and objective	incubator for cell culturing under microgravity
Go forth and multiply? reproduction in space	measures of sleepiness [AD-A205861] p 197 N89-24027	p 192 A89-4311
p 192 A89-41851	Muramyl peptide-enhanced sleep: Pharmacological	SPACECREWS Interpersonal and group-behavior skills training for crew
RESPIRATION Operation consumption rate of operational underwater	optimization of performance	on Space Station p 200 A89-4216
Oxygen consumption rate of operational underwater swimmers	[AD-A205974] p 197 N89-24028	Medical support for manned spaceflight
[AD-A205331] p 197 N89-24025	SODIUM CHLORIDES	p 197 A89-4332
RETINA	is sait at fault [AD-A206518] p 199 N89-24789	SPACING
Additivity of retinal damage for multiple-pulse laser	SOFTWARE TOOLS	Variable plant spacing p 193 N89-2401
exposures	Telerobotics system simulation for space applications	SPATIAL DISTRIBUTION
[AD-A206514] p 198 N89-24032	p 204 A89-43141	Development and evaluation of integrating details: / complex spatial problem solving test
Phylogenetic analysis based on rRNA sequences	SOLAR RADIATION Oxygen, ozone, aerosols and ultraviolet extinction in	[AD-A205860] p 201 N89-2403:
supports the archaebacterial rather than the eocyte tree	geological times p 191 A89-41017	The role of knowledge in visual shape representation
p 191 A89-40125	SOYBEANS	[AD-A206173] p 202 N89-2404
RNA-protein interactions in 30S ribosomal subunits -	Variable plant spacing p 193 N89-24016	SPECTRAL BANDS
Folding and function of 16S rRNA p 191 A89-40877	SPACE FLIGHT TRAINING The training concept for ESA astronauts and the	Night vision goggles (AN/PVS-7) performance issue: and answers
How old is the genetic code? Statistical geometry of tRNA provides an answer p 191 A89-40924	associated facilities p 202 N89-24374	[AD-A206117] p 205 N89-2404
THE PLANTAGE OF THE PARTY PARTY AND THE PARTY PA	•	- F === 7.30 E404

 exposures
 p 198
 N89-24032

 AD-A206514]
 p 198
 N89-24032

 The effects of blast trauma (impulse noise)
 on hearing:

 A parametric study
 p 199
 N89-24786

SPECTRAL ENERGY DISTRIBUTION	TRACKING (POSITION)	Quasi-monochromatic visual environments and the
The effects of blast trauma (impulse noise) on hearing:	Psychometric function reconstruction from adaptive	resting point of accommodation
A parametric study	tracking procedures	[AD-A205938] p 201 N89-24036
[AD-A206180] p 199 N89-24786	[AD-A205668] p 200 N89-24034	VISUAL STIMULI
SPECTRUM ANALYSIS	TRAINING SIMULATORS Design of a MANPRINT tool for predicting personnel	Relating attention to visual mechanisms [AD-A206452] p 202 N89-24042
Spectral analysis of vestibular nystagmus p 194 A89-40499	and training characteristics implied by system design	[AD-A200402] p 202 1109-24042
STRESS (PHYSIOLOGY)	[AD-A206201] p 205 N89-24048	W
Human temperature regulation during exercise after oral	TRANSPORT AIRCRAFT	VV
pyridostigmine administration	Ergonomic design for perspective flight-path displays	WATER BALANCE
[AD-A206032] p 198 N89-24030	p 203 A89-42728	Solute model or cellular energy model: Practical and
Solute model or cellular energy model: Practical and	Display-based communications for advanced transport aircraft	theoretical aspects of thirst during exercise
theoretical aspects of thirst during exercise	[NASA-TM-102187] p 207 N89-24798	[AD-A206143] p 199 N89-24785
[AD-A206143] p 199 N89-24785 SURGERY	TREADMILLS	WEIGHT (MASS)
Recovery of pupillomotor function after cataract	A method of isolating treadmill shock and vibration on	Field-dependence and judgment of weight and color
surgery p 196 A89-42158	spacecraft	revisited: Some implications for the study of sensory discrimination
SYNAPSES	[NASA-TM-100474] p 200 N89-24790 TUNABLE LASERS	[AD-A206141] p 203 N89-24791
Long term synaptic plasticity and learning in neuronal	Free-electron lasers in ultraviolet photobiology	WEIGHTLESSNESS
networks	p 192 A89-41619	Comparative study of astronaut motor behavior during
[AD-A205993] p 201 N89-24038	TYROSINE	ground training $(g = 1)$ and during orbital flight $(g = 0)$
_	Treatment with tyrosine, a neurotransmitter precursor,	p 194 A89-40825 WHEAT
T	reduces environmental stress in humans [AD-A206035] p 201 N89-24039	Automated seed manipulation and planting
-	[AD-A206035] p 201 N89-24039	p 193 N89-24017
TASK COMPLEXITY	11	Automated seed manipulation and planting
Crew procedures and workload of retrofit concepts for	U	p 193 N89-24020
microwave landing system	UI TRAVIOI ET RABIATION	WINDOWS (APERTURES)
[NASA-CR-181700] p 200 N89-24033	ULTRAVIOLET RADIATION Oxygen, ozone, aerosols and ultraviolet extinction in	The effects of window shape and reticle presence on performance in a vertical alignment task
TASKS	geological times p 191 A89-41017	p 203 A89-42153
The relationship between subjective and objective measures of sleepiness	Free-electron lasers in ultraviolet photobiology	WORK CAPACITY
[AD-A205861] p 197 N89-24027	p 192 A89-41619	Brain-wave measures of workload in advanced cockpits:
Development and evaluation of integrating details: A	UNCONSCIOUSNESS	The transition of technology from laboratory to cockpit
complex spatial problem solving test	Observations on the neurophysiologic theory of acceleration (+Gz) induced loss of consciousness	simulator, phase 2
[AD-A205860] p 201 N89-24035	p 196 A89-42159	[NASA-CR-4240] p 207 N89-24797 WORKLOADS (PSYCHOPHYSIOLOGY)
TAXONOMY	UNDERWATER BREATHING APPARATUS	Cabin staff's perception of the impact of flying on their
Origin of the algae p 191 A89-40124	Oxygen consumption rate of operational underwater	physical health p 200 A89-43323
Phylogenetic analysis based on rRNA sequences	swimmers	Crew procedures and workload of retrofit concepts for
supports the archaebacterial rather than the eocyte tree p 191 A89-40125	[AD-A205331] p 197 N89-24025	microwave landing system
TELEOPERATORS	UNDERWATER PHYSIOLOGY Oxygen consumption rate of operational underwater	[NASA-CR-181700] p 200 N89-24033 The role of pilot and automatic onboard systems in future
Space robotics - Intra-vehicular operations	swimmers	rendezvous and docking operations
p 203 A89-41457	[AD-A205331] p 197 N89-24025	[REPT-882-440-116] p 205 N89-24050
Telerobotics system simulation for space applications	USER REQUIREMENTS	Manned interventions at the MTFF: Crew workload
p 204 A89-43141	Human-machine interaction considerations for	aspects p 206 N89-24362
Human Factors in Automated and Robotic Space	interactive software	Brain-wave measures of workload in advanced cockpits:
Systems: Proceedings of a symposium. Part 1 [NASA-CR-182495] p 206 N89-24792	[AD-A206574] p 205 N89-24049 Evaluation, description and invention: Paradigms for	The transition of technology from laboratory to cockpit simulator, phase 2
[NASA-CR-182495] p 206 N89-24792 The human role in space (THURIS) applications study.	human-computer interaction	[NASA-CR-4240] p 207 N89-24797
Final briefing	[AD-A204617] p 207 N89-24796	£
[NASA-CR-183590] p 206 N89-24793		X
Human Factors in Automated and Robotic Space	V	A
Systems: Proceedings of a symposium. Part 2	•	X RAY IRRADIATION
[NASA-CR-182496] p 206 N89-24794	VENTILATION	A low-energy X-ray irradiator for electrophysiological
The human role in space (THURIS) applications study.	Space station ECLSS simplified integrated test	studies
Volume 2: Research analysis and technology report [NASA-CR-183589] p 206 N89-24795	[NASA-TM-100363] p 204 N89-24044 VERTICAL ORIENTATION	[AD-A205388] p 197 N89-24026
TEMPERATURE CONTROL	The effects of window shape and reticle presence on	
Incubator for cell culturing under microgravity	performance in a vertical alignment task	
p 192 A89-43119	p 203 A89-42153	
TEMPERATURE EFFECTS	VERTICAL PERCEPTION	
Solute model or cellular energy model: Practical and	The effects of window shape and reticle presence on performance in a vertical alignment task	
theoretical aspects of thirst during exercise [AD-A206143] p 199 N89-24785	p 203 A89-42153	
THERMAL INSULATION	VESTIBULAR NYSTAGMUS	
The concept and theoretical considerations of a cold	Spectral analysis of vestibular nystagmus	
weather clothing system	p 194 A89-40499	
[AD-A205476] p 205 N89-24046	VESTIBULAR TESTS Adaptation to vection-induced symptoms motion	
THERMAL RESISTANCE	sickness p 195 A89-42156	
The concept and theoretical considerations of a cold	VIBRATION ISOLATORS	
weather clothing system [AD-A205476] p 205 N89-24046	A method of isolating treadmill shock and vibration on	
THERMOREGULATION	spacecraft	
Physiological and behavioral temperature regulation of	[NASA-TM-100474] p 200 N89-24790	
men in simulated nonuniform thermal environments	VIBRATION TESTS	
between 18 and 30 C p 195 A89-42155	A method of isolating treadmill shock and vibration on spacecraft	
Human temperature regulation during exercise after oral		
	[NASA-TM-100474] p 200 N89-24790	
pyridostigmine administration	[NASA-TM-100474] p 200 N89-24790 VISUAL ACCOMMODATION	
[AD-A206032] p 198 N89-24030	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the	
[AD-A206032] p 198 N89-24030 TISSUES (BIOLOGY)	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the resting point of accommodation	
[AD-A206032] p 198 N89-24030 TISSUES (BIOLOGY) The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036	
[AD-A206032] p 198 N89-24030 TISSUES (BIOLOGY) The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen p 196 A89-42440	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036 VISUAL ACUITY	
[AD-A206032] p 198 N89-24030 TISSUES (BIOLOGY) The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen p 196 A89-42440 TOLERANCES (PHYSIOLOGY)	VISUAL ACCOMMODATION Cuasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036 VISUAL ACUITY Cuasi-monochromatic visual environments and the	
[ÅD-A206032] p 198 N89-24030 TISSUES (BIOLOGY) The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen p 196 A89-42440 TOLERANCES (PHYSIOLOGY) Human adaptation to the Tibetan Plateau	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036 VISUAL ACUITY Quasi-monochromatic visual environments and the resting point of accommodation	
[AD-A206032] p 198 N89-24030 TISSUES (BIOLOGY) The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen TOLERANCES (PHYSIOLOGY) Human adaptation to the Tibetan Plateau [AD-A206463] p 198 N89-24031	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036 VISUAL ACUITY Quasi-monochromatic visual environments and the resting point of accommodation	
[ÅD-A206032] p 198 N89-24030 TISSUES (BIOLOGY) The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen p 196 A89-42440 TOLERANCES (PHYSIOLOGY) Human adaptation to the Tibetan Plateau	VISUAL ACCOMMODATION Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036 VISUAL ACUITY Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938] p 201 N89-24036	

VISUAL PERCEPTION

goggles

Depth perception after prolonged usage of night vision poggles p 196 A89-42157

p 192 A89-41860

p 191 A89-41017

p 206 N89-24392

p 191 A89-40124

considerations for

p 205 N89-24049

p 194 A89-40499

p 200 A89-42160

p 195 A89-42155

p 206 N89-24388

n 201 N89-24037

p 199 N89-24369

p 194

A89-40499

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 328)

BANDOPADHYAY, P. C.

India

BANERJEE, T.

activities

BASS, LEN

BAROIN, ANNE

BAZAROV, V. G.

Origin of the algae

Human-machine

interactive software [AD-A206574]

BELENKY, GREGORY

BELIAKOVA, I. A.

BERGLUND, L. G.

between 18 and 30 C

BERTHIER, STEPHANE

BETTMAN, JAMES R.

[AD-A205963]

geological times BARNI, B.

Proterozoic microfossils from manganese orebody

Oxygen, ozone, aerosols and ultraviolet extinction in

Advanced MMI and image handling to support crew

interaction

Triazolam impairs learning and fails to improve sleep

Physiological and behavioral temperature regulation of men in simulated nonuniform thermal environments

EVA Information System: A modern workstation in

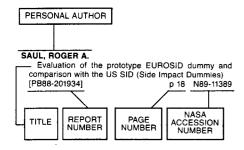
Monitoring information processing and decisions: The MOUSELAB system

Spectral analysis of vestibular nystagmus

Spectral analysis of vestibular nystagmus

in a long-range aerial deployment

Typical Personal Author **Index Listing**



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

[AD-A206143]

ATTANASIO, M.

Is salt at fault [AD-A206518]

_			[70-7203303]	P 201 1103-24001
А			BITTNER, ALVAH C.	
			Design of a MANPRINT tool	for predicting personnel
ACCENSI, A.			and training characteristics in	plied by system design
	p 206 N89-2	24207	[AD-A206201]	p 205 N89-24048
Getting ready for EVA	p 200 1103-2	24307	BLANKENSTEIN, MICHAEL F.	'
ADOUTTE, ANDRE			Additivity of retinal damage	for multiple-pulse laser
Origin of the algae	p 191 A89-4	10124	,	ioi iliuliipie-puise iasei
AHROON, WILLIAM A.			exposures	
The effects of blast trauma (impulse noise) on he	aring:	[AD-A206514]	p 198 N89-24032
A parametric study	,		BLEDSOE, JIM	
[AD-A206180]	p 199 N89-2	24786	Variable plant spacing	p 193 N89-24016
	p 199 1109-2	-4700	Non-destructive plant health	sensing using absorption
ALDERTON, DAVID L.		4.	spectroscopy	p 193 N89-24021
Development and evaluation		IIS: A	BRAMMER, K.	p 100 1100 21021
complex spatial problem solvin				- MTCC: Cdiand
[AD-A205860]	p 201 N89-2	24035	Manned interventions at th	
ALLEN, J. P.			aspects	p 206 N89-24362
Structure and function of	hacterial photosyn	thetic	BROWN, THOMAS H.	
reaction centres	2		Long term synaptic plasticity	and learning in neuronal
ARMSTRONG, LAWRENCE E.	p 101 7100 1		networks	
			[AD-A205993]	p 201 N89-24038
Solute model or cellular en		ii and	BUECKER, H.	F =
theoretical aspects of thirst du	ring exercise		Madical and andiction protecti	blama in anna

N89-24785

p 199 N89-24789

p 199

C

Medical and radiation protection problems in space

A 1 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A					
The role of pilot and automatic or	board syst	ems in future	•		
rendezvous and docking operation	าร		CAIN, B.		
[REPT-882-440-116]	p 205	N89-24050	The concept and theoretical	consideratio	ns of a cold
			weather clothing system	- 005	NIOO 04040
В			[AD-A205476]	p 205	N89-24046
			CALDICHOURY, M.		
BACHELLERIE, JEAN PIERRE			The role of pilot and automatic of		ems in tuture
Origin of the algae	p 191	A89-40124	rendezvous and docking operation		
BADA, JEFFREY L.	F		[REPT-882-440-116]	p 205	N89-24050
Extraterrestrial amino acids in	Cretacen	us/Tertiary	CARRASQUILLO, ROBYN L.		
boundary sediments at Stevns Klii			Space station ECLSS simplifie	d integrated	test
boundary sediments at Stevils Kill		A89-43425	[NASA-TM-100363]	p 204	N89-24044
DAFRICOU BETER	p 201	A03-43423	CARROLL, JOHN M.	•	
BAERTSCH, PETER		ain sieknoss	Evaluation, description and in	vention: Par	adigms for
Coagulation and fibrinolysis in a			human-computer interaction		•
and beginning pulmonary edema	p 194	A89-40851	[AD-A204617]	p 207	N89-24796
BAGDIGIAN, ROBERT M.			CHANGCHIEN, LI-MING	F	
Space station ECLSS simplified				C ribanama	d aubunita
[NASA-TM-100363]	p 204	N89-24044	RNA-protein interactions in 30		
BANDERET, LOUIS E.			Folding and function of 16S rRN	н різі	A89-40877
Treatment with tyrosine, a neur	otransmitte	er precursor,	COOHILL, THOMAS P.		
reduces environmental stress in h	umans		Free-electron lasers in ultravio		
[AD-A206035]	p 201	N89-24039		p 192	A89-41619

CORTINOVIS, R.				
Advanced MMI an	d image han	dling to su	pport c	rev
activities	•	p 206	N89-24	392
COUTAZ, JOELLE				
Human-machine	interaction	considera	itions	fo
interactive software				
[AD-A206574]		p 205	N89-24	049
CROWLEY, JOHN S.				
Cerebral laterality	and hand	dedness ir	n aviat	ion
Performance and sele	ection implica	tions		
[AD-A206196]		p 199	N89-24	787
CYMERMAN, A.				
Operation Everest	II - Adaptation	ons in hum	an skel	eta
muscle		p 195	A89-40	853
CYMERMAN, ALLEN				

PERSONAL AUTHOR INDEX

Operation Everest II - Ada	aptations in human skeletal
muscle	p 195 A89-40853
CYMERMAN, ALLEN	
Operation Everest II - Maxin	nal oxygen uptake at extreme
altitude	p 195 A89-40852
	·
_	
D	
DAVIS, ROBERT I.	
The effects of blast trauma	(impulse noise) on hearing:
A parametric study	
[AD-A206180]	p 199 N89-24786
DEMOND, F. J.	
Crew training aspects	p 202 N89-24396
DEUTSCH, STANLEY	•
	nated and Robotic Space
Systems: Proceedings of a sy	
[NASA-CR-182495]	p 206 N89-24792
DICK, ALFRED O.	P 200 .100 24/02
	ool for predicting personnel
and training characteristics	
[AD-A206201]	p 205 N89-24048
•	p 205 1469-24046
DRESS, ANDREAS	den Caratesiani nanamata af
	de? Statistical geometry of
tRNA provides an answer	p 191 A89-40924
DURAND-ZALESKI, ISABELLE	
Man in Space - A survey of	
	p 197 A89-43640
E	
_	
EIGEN, MANFRED	
	de? Statistical geometry of
tRNA provides an answer	p 191 A89-40924
ELLINGSTAD, VERNON	p 191 A89-40924
	al environments and the
resting point of accommodati	
[AD-A205938]	p 201 N89-24036
	p 201 1109-24036
ELLIOTT, ALBERS H.	
Neurochemical control of c	
[AD-A206213]	p 199 N89-24788
F	
•	
FARMOWORTH: T	
FARNSWORTH, B.	
	cal considerations of a cold
weather clothing system	
[AD-A205476]	p 205 N89-24046
FATH, JANET L.	
	mputer Aided Instruction)
architecture for troublesho	oting in complex dynamic

rannomonin, b.		
The concept and theoretic	cal consideration	ins of a cold
weather clothing system		
[AD-A205476]	p 205	N89-24046
FATH, JANET L.		
An ICAI (Intelligent Co	mputer Aided	Instruction)
architecture for troublesh	ooting in comp	olex dynamic
systems		
[AD-A205434]	p 204	N89-24045
FEHER, G.		
Structure and function of	f bacterial pho	otosynthetic
reaction centres	p 191	A89-40118
FEHSE, W.		
The role of pilot and automa	itic onboard sys	tems in future
rendezvous and docking ope	rations	
[REPT-882-440-116]	p 205	N89-24050
FINE, BERNARD J.		

FOGLEMAN, GUY

FOGLEMAN, GUY Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive summary and overview p 194 N89-24022 [NASA-CP-10026-VOL-1] Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 2: Abstracts,

candidate experiments and feasibility study [NASA-CP-10026-VOL-2] p 194 N89-24023 FONDA, MARK L.

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive

summary and overview
[NASA-CP-10026-VOL-1] p 194 N89-24022 Gas-Grain Simulation Facility: Fundamental studies of

particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study p 194 N89-24023 [NASA-CP-10026-VOL-2] FRANCESCONI, RALPH P.

Patterns of human drinking: Effects of exercise, water temperature and food consumption

p 198 N89-24029 [AD-A2060311 FRANCIOLLI, MARIO

Coagulation and fibrinolysis in acute mountain sickness p 194 A89-40851

and beginning pulmonary edema FRAZER, LANCE p 192 A89-41851

Go forth and multiply?
FREEMAN. CHARLES R.

The relationship between subjective and objective measures of sleepiness p 197 N89-24027 [AD-A205861]

G

GARCIA, RAY

Automated seed manipulation and planting p 193 N89-24017 Automated seed manipulation and planting

p 193 N89-24020

GARGIR, G. The Hermes system training concept

p 202 N89-24375

GARRIGAN, JAMES J. Triazolam impairs learning and fails to improve sleep

in a long-range aerial deployment GETZSCHMANN. A. p 200 A89-42160

The role of pilot and automatic onboard systems in future rendezvous and docking operations [REPT-882-440-116] p 205 N89-24050

GOMEZ, STEVEN A.

The relationship between subjective and objective measures of sleepiness

p 197 N89-24027 [AD-A205861]

GOUY, MANOLO Phylogenetic analysis based on rRNA sequences

supports the archaebacterial rather than the eocyte tree p 191 A89-40125

GOVINDARAJ, T. An ICAI (Intelligent Computer Aided Instruction) architecture for troubleshooting in complex dynamic

systems [AD-A205434] p 204 N89-24045 GREEN. H. J.

Operation Everest II - Adaptations in human skeletal muscle p 195 A89-40853

GREENLEAF, J. E. Orthostatic responses following 30-day bed rest

deconditioning with isotonic and isokinetic exercise p 195 A89-42152 GROVES, BERTRON M.

Operation Everest II - Maximal oxygen uptake at extreme p 195 A89-40852 altitude

GWOSDOW, A. R. Physiological and behavioral temperature regulation of men in simulated nonuniform thermal environments between 18 and 30 C p 195 A89-42155

H

HAEBERLI, ANDRE

Coagulation and fibrinolysis in acute mountain sickness p 194 A89-40851 and beginning pulmonary edema HAINES, RICHARD F.

The effects of window shape and reticle presence on performance in a vertical alignment task

p 203 A89-42153

HAMERNIK, ROGER P. The effects of blast trauma (impulse noise) on hearing: A parametric study p 199 N89-24786

[AD-A206180]

HAMMERBORG, DAG

Evoked potential and other CNS reactions during a heliox p 195 A89-42154 dive to 360 msw

HANNA, THOMAS E.

Psychometric function reconstruction from adaptive tracking procedures [AD-A205668] p 200 N89-24034

HARDING, R. M.

Medical support for manned spaceflight

p 197 A89-43325 HARRIS, REGINA

Design of a MANPRINT tool for predicting personnel and training characteristics implied by system design (AD-A206201) p 205 N89-24048

HARTE, KAREN

Ergonomic design for perspective flight-path displays p 203 A89-42728

HASKELL, IAN

Ergonomic design for perspective flight-path displays p 203 A89-42728

HERRERA, JAVIER

Automated seed manipulation and planting p 193 N89-24017 Automated seed manipulation and planting

p 193 N89-24020

HOLCOMB, SCOTT

Automated seed manipulation and planting p 193 N89-24017

Automated seed manipulation and planting n 193 N89-24020

HOPKINS, H. D.

The training concept for ESA astronauts and the associated facilities p 202 N89-24374

HORST, RICHARD L.

Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit simulator, phase 2

[NASA-CR-4240] p 207 N89-24797 HOUSTON, C. S.

Operation Everest II - Adaptations in human skeletal muscle p 195 A89-40853

HU, SENQI

Adaptation to vection-induced symptoms p 195 A89-42156 sickness

HUBBARD, ROGER W.

Patterns of human drinking: Effects of exercise, water temperature and food consumption p 198 N89-24029

[AD-A206031] Solute model or cellular energy model: Practical and theoretical aspects of thirst during exercise

[AD-A206143] p 199 N89-24785

HUNTINGTON, JUDITH L.

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive summary and overview
[NASA-CP-10026-VOL-1]

p 194 N89-24022 Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study

p 194 N89-24023 [NASA-CP-10026-VOL-2]

JOHNSON, ERIC J.

Monitoring information processing and decisions: The MOUSELAB system AD-A2059631 p 201 N89-24037

JOHNSON, LAVERNE C.

The relationship between subjective and objective measures of sleepiness

[AD-A205861] p 197 N89-24027 JONSSON, JON E.

Crew procedures and workload of retrofit concepts for microwave landing system

[NASA-CR-181700] p 200 N89-24033 JOOP, OTFRIED

Incubator for cell culturing under microgravity p 192 A89-43119

JORDAN, KEVIN

The effects of window shape and reticle presence on performance in a vertical alignment task p 203 A89-42153

K

KADUK, B. G.

Spectral analysis of vestibular nystagmus p 194 A89-40499

KALATOZISHVÌLI, M. D.

Variation of cytoplasmic RNA in the rat's motor cortex neurons and caudate nuclei due to hypokinesia p 192 A89-42405

KAMPFER, GEORG

Manned interventions at the MTFF: Crew workload aspects p 206 N89-24362 KEEPENCE, BARRY

Space robotics - Intra-vehicular operations p 203 A89-41457

KELLY, PAUL

Automated seed manipulation and planting p 193 N89-24017

Automated seed manipulation and planting p 193 N89-24020

KERN. PETER Incubator for cell culturing under microgravity

p 192 A89-43119 KING, P. F. Fit to fly? Some common problems in otolaryngology

p 196 A89-43324 KIRSCHVINK, JOSEPH

Magnetofossil dissolution in a palaeomagnetically p 192 A89-41113 unstable deep-sea sediment KLEIN, K. E.

Medical and radiation protection problems in space p 199 N89-24369

KNAFELC, M. E.

Oxygen consumption rate of operational underwater [AD-A205331] p 197 N89-24025

KOCH, KENNETH L. Adaptation to vection-induced symptoms motion

sickness p 195 A89-42156 KOLKA, MARGARET A.

Human temperature regulation during exercise after oral pyridostigmine administration

AD-A2060321 p 198 N89-24030 KRING, G. ECLS for Columbus and Hermes p 205 N89-24354

KRUEGER, JAMES M. Muramyl peptide-enhanced sleep: Pharmacological optimization of performance

[AD-A205974] p 197 N89-24028 KRUITHOF, EGBERT K. O.

Coagulation and fibrinolysis in acute mountain sickness p 194 A89-40851 and beginning pulmonary edema KRUSER, DANA S.

Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium, Part 1

(NASA-CR-182495) p 206 N89-24792 KUIPER, D. F.

The Hermes Robot Arm p 204 A89-43074

LARROQUE, PIERRE EVA Information System: A modern workstation in p 206 N89-24388

LEE, ALFRED T. Display-based communications for advanced transport

aircraft [NASA-TM-102187] p 207 N89-24798 LEEK, MARJORIE R.

Psychometric function reconstruction from adaptive tracking procedures

[AD-A205668] p 200 N89-24034 LEFTHERIOTIS, G. Orthostatic responses following 30-day bed rest

deconditioning with isotonic and isokinetic exercise training LI, WEN-HSIUNG p 195 A89-42152

Phylogenetic analysis based on rRNA sequences supports the archaebacterial rather than the eocyte tree

p 191 A89-40125 LIEBERMAN, HARRIS R. Treatment with tyrosine, a neurotransmitter precursor,

reduces environmental stress in humans [AD-A206035] p 201 N89-24039 LILIENTHAL, MICHAEL

Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938]

p 201 N89-24036 LIND, ROBERT H.

is salt at fault [AD-A2065181 p 199 N89-24789 LINDEMANN, BJOERN F.

How old is the genetic code? Statistical geometry of tRNA provides an answer

LLINAS, RODOLFO R. The intrinsic electrophysiological properties mammalian neurons - Insights into central nervous system function p 191 A89-40971

M

MAHAFFEY, DAVID L.

Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit simulator, phase 2 [NASA-CR-4240] p 207 N89-24797

MANUKIAN, ARA	P	SAVCHUK, L. A.
Plant health sensing p 193 N89-24018	•	Spectral analysis of vestibular nystagmus
Non-destructive plant health sensing using absorption	PAUL, RASHMI	p 194 A89-40499
spectroscopy p 193 N89-24021	Oxygen, ozone, aerosols and ultraviolet extinction in geological times p 191 A89-41017	SCHAEFER, R.
MARRISON, CLAIRE	geological times p 191 A89-41017 PAYNE, JOHN W.	ECLS for Columbus and Hermes p 205 N89-24354
Cabin staff's perception of the impact of flying on their physical health p 200 A89-43323	Monitoring information processing and decisions: The	SCHAUER, D. A. A low-energy X-ray irradiator for electrophysiological
MARSHALL, LYNNE	MOUSELAB system	studies
Psychometric function reconstruction from adaptive	[AD-A205963] p 201 N89-24037 PEARCE, MICHAEL	[AD-A205388] p 197 N89-24026
tracking procedures	Plant health sensing p 193 N89-24018	SCHKADE, DAVID A.
[AD-A205668] p 200 N89-24034 MAUTE. P.	Non-destructive plant health sensing using absorption	Monitoring information processing and decisions: The MOUSELAB system
The role of pilot and automatic onboard systems in future	spectroscopy p 193 N89-24021	[AD-A205963] p 201 N89-24037
rendezvous and docking operations	PELLMAR, T. C. A low-energy X-ray irradiator for electrophysiological	SCHROER, BERNARD J.
[REPT-882-440-116] p 205 N89-24050	studies	Telerobotics system simulation for space applications
MAYBEE, GEORGE W.	[AD-A205388] p 197 N89-24026	p 204 A89-43141
The human role in space (THURIS) applications study. Final briefing	PENETAR, DAVID M.	SCHUNK, RICHARD G. Space station ECLSS simplified integrated test
[NASA-CR-183590] p 206 N89-24793	Triazolam impairs learning and fails to improve sleep in a long-range aerial deployment p 200 A89-42160	[NASA-TM-100363] p 204 N89-24044
The human role in space (THURIS) applications study.	PERASSO, ROLAND	SCHWARTZ, DEBORAH E.
Volume 2: Research analysis and technology report	Origin of the algae p 191 A89-40124	Gas-Grain Simulation Facility: Fundamental studies of
[NASA-CR-183589] p 206 N89-24795 MCKELVY, COLLEEN	PERSICO, R. Advanced MMI and image handling to support crew	particle formation and interactions. Volume 1: Executive summary and overview
Plant health sensing p 193 N89-24018	activities p 206 N89-24392	[NASA-CP-10026-VOL-1] p 194 N89-24022
MITCHELL, CHRISTINE M.	PETERS, DANIEL R.	Gas-Grain Simulation Facility: Fundamental studies of
An ICAI (Intelligent Computer Aided Instruction)	Recovery of pupillomotor function after cataract	particle formation and interactions. Volume 2: Abstracts,
architecture for troubleshooting in complex dynamic	surgery p 196 A89-42158 PETERSEN, STEVEN E.	candidate experiments and feasibility study [NASA-CP-10026-VOL-2] p 194 N89-24023
systems [AD-A205434] p 204 N89-24045	The attention system of the human brain	SHAUD, JOHN A.
MODI, VINOD J.	[AD-A206157] p 202 N89-24040	Aircraft coordination training in the U.S. Air Force Air
A formulation for studying dynamics of the Space Station	PETUSHKOV, N. M.	Training Command p 200 A89-42162
based MRMS and its application p 203 A89-40811	The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of	SHEEHY, JAMES B.
MOHLER, STANLEY R.	seamen p 196 A89-42440	Depth perception after prolonged usage of night vision
The aviation medical examiner of the 1990s and beyond p 196 A89-43322	PITTERMANN, FRANZ	goggles p 196 A89-42157 SHERIDAN, THOMAS B.
MOORE, LORNA G.	EVA Information System: A modern workstation in	Human Factors in Automated and Robotic Space
Human adaptation to the Tibetan Plateau	space p 206 N89-24388 PLAKHATNIUK, V. I.	Systems: Proceedings of a symposium. Part 1
[AD-A206463] p 198 N89-24031	Testing for irregularities of the cardiac rhythm and	[NASA-CR-182495] p 206 N89-24792
MORITA, YASUHIRO	conduction in flight personnel by means of a combined	SHULMAN, GORDON L.
A formulation for studying dynamics of the Space Station based MRMS and its application p 203 A89-40811	functional test p 196 A89-42439	Relating attention to visual mechanisms [AD-A206452] p 202 N89-24042
MORROW, WALTER B., JR.	POPOV, V. K. Dependence of optokinetic nystagmus on the width of	SILS, INGRID V.
Night vision goggles (AN/PVS-7) performance issues	the vision field p 194 A89-40498	Patterns of human drinking: Effects of exercise, water
and answers	POSNER, MICHAEL I.	temperature and food consumption
[AD-A206117] p 205 N89-24047 MUELLER-BREITKREUTZ, W.	The attention system of the human brain	[AD-A206031] p 198 N89-24029
Crew training aspects p 202 N89-24396	[AD-A206157] p 202 N89-24040 POWERS, TED	SIVITZ, HERBERT Automated seed manipulation and planting
MUIR, HELEN	RNA-protein interactions in 30S ribosomal subunits -	p 193 N89-24017
Cabin staff's perception of the impact of flying on their	Folding and function of 16S rRNA p 191 A89-40877	Automated seed manipulation and planting
physical health p 200 A89-43323 MUKHAMEDOV, E. G.	PREISS, H.	p 193 N89-24020
Testing for irregularities of the cardiac rhythm and	ECLS for Columbus and Hermes p 205 N89-24354	SPINWEBER, CHERYL L.
conduction in flight personnel by means of a combined	^	The relationship between subjective and objective measures of sleepiness
functional test p 196 A89-42439	Q	[AD-A205861] p 197 N89-24027
MUNSON, ROBERT C. Brain-wave measures of workload in advanced cockpits:	QU, LIANG HU	STEPHENSON, LOU A.
The transition of technology from laboratory to cockpit	Origin of the algae p 191 A89-40124	Human temperature regulation during exercise after oral
simulator, phase 2	,	pyridostigmine administration
[NASA-CR-4240] p 207 N89-24797	R	[AD-A206032] p 198 N89-24030 STERN. ROBERT M.
MYERS, SCOTT	••	Adaptation to vection-induced symptoms motion
Automated seed manipulation and planting p 193 N89-24017	REDMON, JOHN W., JR.	sickness p 195 A89-42156
Automated seed manipulation and planting	Astronaut tool development: An orbital replaceable	STERN, SETH
p 193 N89-24020	unit-portable handhold p 204 N89-23904 REDMOND, DANIEL P.	RNA-protein interactions in 30S ribosomal subunits -
8.0	Triazolam impairs learning and fails to improve sleep	Folding and function of 16S rRNA p 191 A89-40877 STRAUB. P. WERNER
N	in a long-range aerial deployment p 200 A89-42160	Coagulation and fibrinolysis in acute mountain sickness
NEW ACTION IN O	REES, D. C.	and beginning pulmonary edema p 194 A89-40851
NEUHAEUSER, H. G. Crew training aspects p 202 N89-24396	Structure and function of bacterial photosynthetic reaction centres p 191 A89-40118	STROEBEL, VOLKER
NEVILL, GALE E., JR.	REEVES, JOHN T.	Incubator for cell culturing under microgravity p 192 A89-43119
Advanced space design program to the Universities	Operation Everest II - Maximal oxygen uptake at extreme	SUMMERS, LELAND G.
Space Research Association and the National Aeronautics	altitude p 195 A89-40852	Crew procedures and workload of retrofit concepts for
and Space Administration [NASA-CR-180450] p 192 N89-24015	ROCK, PAUL B. Operation Everest II - Maximal oxygen uptake at extreme	microwave landing system
NICHOLAS, JOHN M.	altitude p 195 A89-40852	[NASA-CR-181700] p 200 N89-24033
Interpersonal and group-behavior skills training for crews	ROSENBERG, ERIKA L.	SUTHERLAND, JOHN C. Free-electron lasers in ultraviolet photobiology
on Space Station p 200 A89-42163	The effects of window shape and reticle presence on	p 192 A89-41619
NOLLER, HARRY F. RNA-protein interactions in 30S ribosomal subunits -	performance in a vertical alignment task p 203 A89-42153	SUTTON, J. R.
Folding and function of 16S rRNA p 191 A89-40877	ROSENDO, MANNY	Operation Everest II - Adaptations in human skeletal
	Automated seed manipulation and planting	muscle p 195 A89-40853
0	p 193 N89-24017	SUTTON, JOHN R. Operation Everest II - Maximal oxygen uptake at extreme
•	Automated seed manipulation and planting p 193 N89-24020	altitude p 195 A89-40852
OGLE, KATHYRN Y.	p 130 1103-24020	SYSLO, STEPH
Space station ECLSS simplified integrated test	S	Plant health sensing p 193 N89-24018
[NASA-TM-100363] p 204 N89-24044 OKAMURA, M. Y.	•	SZLYK, PATRICIA C. Patterns of human drinking: Effects of exercise, water
Structure and function of bacterial photosynthetic	SAHA, A. K.	temperature and food consumption
reaction centres p 191 A89-40118	Oxygen, ozone, aerosols and ultraviolet extinction in	[AD-A206031] p 198 N89-24029
OSCZEVSKI, R.	geological times p 191 A89-41017	SZLYK, PATRICK C.
The concept and theoretical considerations of a cold weather clothing system	SAUND, ERIC The role of knowledge in visual shape representation	Solute model or cellular energy model: Practical and theoretical aspects of thirst during exercise
[AD-A205476] p 205 N89-24046	[AD-A206173] p 202 N89-24041	[AD-A206143] p 199 N89-24785
•	· · · · · · · · · · · · · · · · · · ·	•

TAFFORIN, CAROLE

Comparative study of astronaut motor behavior during ground training (g = 1) and during orbital flight (g = 0)p 194 A89-40825

TELEZHNIKOV. A. V.

Spectral analysis of vestibular nystagmus p 194 A89-40499

THORNTON, WILLIAM E.

A method of isolating treadmill shock and vibration on

[NASA-TM-100474] TIETZE, MANFRED

p 200 N89-24790

How old is the genetic code? Statistical geometry of p 191 A89-40924 tRNA provides an answer TISHCHENKO, ARTUR A.

p 204 A89-43024 TIUNOV. L. A.

The value of polarographic measurements of tissue-oxygen pressure in evaluating functional state of seamen p 196 A89-42440

TOBIAS, A.

The role of pilot and automatic onboard systems in future rendezvous and docking operations

[REPT-882-440-116] p 205 N89-24050

TÓDOROVA, V. S. Dependence of optokinetic nystagmus on the width of the vision field p 194 A89-40498

TRAUTMAN, EDWARD Quasi-monochromatic visual environments and the

resting point of accommodation (AD-A205938)

p 201 N89-24036 TRAUTMAN, MARY A.

Quasi-monochromatic visual environments and the resting point of accommodation

p 201 N89-24036 [AD-A205938] TSENG, FAN T.

Telerobotics system simulation for space applications

p 204 A89-43141 TURRENTINE, GEORGE A.

The effects of blast trauma (impulse noise) on hearing: A parametric study [AD-A206180] p 199 N89-24786

TYCHSEN, LAWRENCE

Recovery of pupillomotor function after cataract p 196 A89-42158 surgery

U

LIMETANI. YOJI

Resolved motion rate control of space manipulators with p 203 A89-42808 generalized Jacobian matrix

VAERNES, RAGNAR J.

Evoked potential and other CNS reactions during a heliox p 195 A89-42154 dive to 360 msw

VALI, HOJATOLLAH

Magnetofossil dissolution in a palaeomagnetically unstable deep-sea sediment p 192 A89-41113

VASEY, MICHAEL W.

Adaptation to vection-induced symptoms motion p 195 A89-42156 sickness

VASIUTIN, VLADIMIR V.

Space coloristics p 204 A89-43024

VERSENDAAL, J. M.

Direct manipulation and other styles of man-machine interaction p 204 N89-24043

[PB89-146070]

WADE, C. E.

Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise p 195 A89-42152

WEISS, LEE

Variable plant spacing p 193 N89-24016 Non-destructive plant health sensing using absorption p 193 N89-24021 spectroscopy

WHINNERY, JAMES E.

Observations on the neurophysiologic theory of acceleration (+Gz) induced loss of consciousness p 196 A89-42159

WICKENS, CHRISTOPHER D.

Ergonomic design for perspective flight-path displays p 203 A89-42728

WIELAND, PAUL O.

Space station ECLSS simplified integrated test p 204 N89-24044 [NASA-TM-100363]

WILKINSON, MICHAEL

Depth perception after prolonged usage of night vision p 196 A89-42157

WINKLER-OSWATITSCH, RUTHILD

How old is the genetic code? Statistical geometry of tRNA provides an answer p 191 A89-40924 WOLSEFER, DAVE

Automated seed manipulation and planting
p 193 N89-24017 Automated seed manipulation and planting

p 193 N89-24020

Υ

YOSHIDA, KAZUYA

Resolved motion rate control of space manipulators with generalized Jacobian matrix p 203 A89-42808 YOUNG, P. M.

Operation Everest II - Adaptations in human skeletal p 195 A89-40853

Z

ZEMAN. G. H.

A low-energy X-ray irradiator for electrophysiological

[AD-A205388]

p 197 N89-24026

ZHANG, SHOU X

Telerobotics system simulation for space applications p 204 A89-43141

ZHAO, MEIXUN

Extraterrestrial amino acids in Cretaceous/Tertiary boundary sediments at Stevns Klint, Denmark

p 207 A89-43425

ZUCLICH, JOSEPH A.

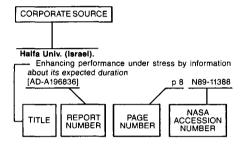
Additivity of retinal damage for multiple-pulse laser exposures [AD-A206514] p 198 N89-24032

CORPORATE SOURCE INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 328)

October 1989

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

Advanced Resource Development Corp., Columbia,

Brain-wave measures of workload in advanced cockpits: The transition of technology from laboratory to cockpit simulator, phase 2 [NASA-CR-4240]

p 207 N89-24797

Aerospatiale, Paris (France).

The role of pilot and automatic onboard systems in future rendezvous and docking operations [REPT-882-440-116] p 205 N89-24050

Analytics, Inc., Willow Grove, PA.

Design of a MANPRINT tool for predicting personnel

and training characteristics implied by system design p 205 [AD-A206201] Armed Forces Radiobiology Research Inst., Bethesda,

A low-energy X-ray irradiator for electrophysiological studies

[AD-A205388] p 197 N89-24026

Army Research Inst. of Environmental Medicine, Natick, MA.

Patterns of human drinking: Effects of exercise, water temperature and food consumption

n 198 N89-24029 [AD-A206031] Human temperature regulation during exercise after oral

pyridostigmine administration p 198 N89-24030

[AD-A206032] Treatment with tyrosine, a neurotransmitter precursor, reduces environmental stress in humans

p 201 N89-24039 [AD-A206035] p 201 N89-24039 Solute model or cellular energy model: Practical and theoretical aspects of thirst during exercise

p 199 N89-24785 [AD-A206143]

is salt at fault

[AD-A206518] p 199 N89-24789 Field-dependence and judgment of weight and color revisited: Some implications for the study of sensory

discrimination [AD-A206141] p 203 N89-24791

Carnegie-Mellon Univ., Pittsburgh, PA.

considerations Human-machine interaction interactive software

(AD-A206574) p 205 N89-24049 Center for Night Vision and Electro-Optics, Fort

Belvoir, VA. Night vision goggles (AN/PVS-7) performance issues and answers

[AD-A206117] p 205 N89-24047 Centre National d'Etudes Spatiales, Toulouse (France).

The Hermes system training concept p 202 N89-24375

City of Hope Medical Center, Duarte, CA. Long term synaptic plasticity and learning in neuronal networks

[AD-A205993] p 201 N89-24038

Colorado Univ., Denver.

Human adaptation to the Tibetan Plateau [AD-A206463] p 198 N89-24031

n

Defence Research Establishment, Ottawa (Ontario).

The concept and theoretical considerations of a cold

eather clothing system p 205 N89-24046 [AD-A205476]

Deutsche Forschungs- und Versuchsanstalt fuer Luftund Raumfahrt, Cologne (Germany, F.R.).

Medical and radiation protection problems in space p 199

p 202 N89-24396 Crew training aspects

Dornier-Werke G.m.b.H., Friedrichshafen (Germany,

p 205 N89-24354 ECLS for Columbus and Hermes EVA Information System: A modern workstation in p 206 N89-24388

Duke Univ., Durham, NC.

Monitoring information processing and decisions: The MOUSELAB system p 201 N89-24037 (AD-A205963)

Elektronik-System G.m.b.H., Munich (Germany, F.R.). Manned interventions at the MTFF: Crew workload

aspects p 206 N89-24362 European Space Agency, Paris (France).

The training concept for ESA astronauts and the associated facilities p 202 N89-24374

European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

Getting ready for EVA p 206 N89-24387

Florida Univ., Gainesville.

Advanced space design program to the Universities Space Research Association and the National Aeronautics

and Space Administration [NASA-CR-180450] p 192 N89-24015 Variable plant spacing p 193 N89-24016

Automated seed manipulation and planting N89-24017 p 193

p 193 N89-24018 Plant health sensing

Automated seed manipulation and planting p 193 N89-24020

Non-destructive plant health sensing using absorption p 193 N89-24021 spectroscopy

G

General Electric Co., Moffett Field, CA.

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 1: Executive ummary and overview INASA-CP-10026-VOL-11 p 194 N89-24022

Gas-Grain Simulation Facility: Fundamental studies of particle formation and interactions. Volume 2: Abstracts, candidate experiments and feasibility study
[NASA-CP-10026-VOL-2] p 194 p 194

Georgia Inst. of Tech., Atlanta.

An ICAI (Intelligent Computer Aided Instruction) architecture for troubleshooting in complex dynamic

[AD-A205434] p 204 N89-24045

Georgia State Univ., Atlanta.

Neurochemical control of circadian rhythms

p 199 N89-24788 [AD-A206213]

IBM Watson Research Center, Yorktown Heights, NY. Evaluation, description and invention: Paradigms for

human-computer interaction [AD-A204617] p 207 N89-24796

Krug International, San Antonio, TX.

Additivity of retinal damage for multiple-pulse laser [AD-A206514] p 198 N89-24032

LABEN Space Instrumentation and Systems, Milan

(Italy). Advanced MMI and image handling to support crew activities p 206 N89-24392

Letterman Army Inst. of Research, San Francisco, CA. Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise p 195 A89-42152 training

Massachusetts Inst. of Tech., Cambridge.

The role of knowledge in visual shape representation p 202 N89-24041

McDonnell-Douglas Astronautics Co., Huntsville, AL. The human role in space (THURIS) applications study.

[NASA-CR-183590] p 206 N89-24793 The human role in space (THURIS) applications study. Volume 2: Research analysis and technology report [NASA-CR-183589] p 206 N89-24795

McDonnell-Douglas Corp., Long Beach, CA. Crew procedures and workload of retrofit concepts for microwave landing system

[NASA-CR-181700] p 200 N89-24033

National Academy of Sciences - National Research Council, Washington, DC.

A strategy for space biology and medical science for the 1980s and 1990s [NASA-CR-184895]

Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 1

[NASA-CR-182495] p 206 N89-24792 Human Factors in Automated and Robotic Space Systems: Proceedings of a symposium. Part 2

(NASA-CR-182496) p 206 N89-24794 National Aeronautics and Space Administration. Ames
Research Center, Moffett Field, CA.

Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise p 195 A89-42152 training

The effects of window shape and reticle presence on performance in a vertical alignment task

p 203 A89-42153 Display-based communications for advanced transport

[NASA-TM-102187] p 207 N89-24798 National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center, Houston, TX,

A method of isolating treadmill shock and vibration on

[NASA-TM-100474]

p 200 N89-24790

National Aeronautics and Space Administration.

Marshall Space Flight Center, Huntsville, AL.
Astronaut tool development: An orbital replaceable p 204 N89-23904

unit-portable handhold p 204 N89
Space station ECLSS simplified integrated test
[NASA-TM-100363] p 204 N89 p 204 N89-24044

Naval Health Research Center, San Diego, CA.

The relationship between subjective and objective measures of sleepiness

p 197 N89-24027 [AD-A205861] Navai Submarine Medical Research Lab., Groton, CT.

Psychometric function reconstruction from adaptive

tracking procedures [AD-A205668] p 200 N89-24034

Navy Experimental Diving Unit, Panama City, FL. Oxygen consumption rate of operational underwater

[AD-A205331] p 197 N89-24025

Navy Personnel Research and Development Center,

San Diego, CA.

Development and evaluation of integrating details: A complex spatial problem solving test [AD-A205860] p 201 N89-24035

Pennsylvania State Univ., Hershey.

Adaptation to vection-induced symptoms motion

p 195 A89-42156

Pennsylvania State Univ., University Park. Adaptation to vection-induced symptoms motion

p 195 A89-42156

S

San Jose State Univ., CA.

The effects of window shape and reticle presence on performance in a vertical alignment task

p 203 A89-42153

School of Aerospace Medicine, Brooks AFB, TX.

Cerebral laterality and handedness in aviation:
Performance and selection implications

p 199 N89-24787

[AD-A206196] South Dakota Univ., Vermillion.

Quasi-monochromatic visual environments and the resting point of accommodation [AD-A205938]

p 201 N89-24036 State Univ. of New York, Plattsburgh. The effects of blant terror in the state of blant terror in the state of the stat The effects of blast trauma (impulse noise) on hearing: A parametric study

[AD-A206180] p 199 N89-24786

T

Technische Hogeschool, Delft (Netherlands).

Direct manipulation and other styles of man-machine interaction p 204 N89-24043

[PB89-146070] Tennessee Univ., Memphis.

Muramyl peptide-enhanced sleep: Pharmacological optimization of performance

[AD-A205974] p 197 N89-24028

W

Washington Univ., Saint Louis, MO.

The attention system of the human brain p 202 N89-24040 [AD-A206157]

Relating attention to visual mechanisms

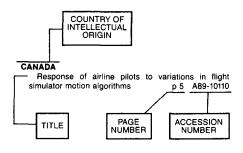
[AD-A206452] p 202 N89-24042

FOREIGN TECHNOLOGY INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 328)

October 1989

Typical Foreign Technology Index Listing



Listings in this index are arranged alphabetically by country of intellectual origin. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the citation in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

B

BULGARIA

Dependence of optokinetic nystagmus on the width of p 194 A89-40498 the vision field

C

CANADA

A formulation for studying dynamics of the Space Station based MRMS and its application p 203 A89-40811 Operation Everest II - Adaptations in human skeletal p 195 A89-40853 muscle

The concept and theoretical considerations of a cold weather clothing system [AD-A205476] p 205 N89-24046

CHINA, PEOPLE'S REPUBLIC OF

Telerobotics system simulation for space applications p 204 A89-43141

FRANCE

Origin of the algae p 191 A89-40124 Comparative study of astronaut motor behavior during ground training (g = 1) and during orbital flight (g = 0)

p 194 A89-40825 Man in Space - A survey of the medical literature

The role of pilot and automatic onboard systems in future rendezvous and docking operations [REPT-882-440-116] p 205 N89-24050

The training concept for ESA astronauts and the p 202 N89-24374 associated facilities

The Hermes system training concept

p 202 N89-24375

p 197 A89-43640

G

GERMANY, FEDERAL REPUBLIC OF

How old is the genetic code? Statistical geometry of tRNA provides an answer p 191 A89-40924 Magnetofossil dissolution in a palaeomagnetically unstable deep-sea sediment p 192 A89-41113 Incubator for cell culturing under microgravity p 192 A69-43119
ECLS for Columbus and Hermes p 205 N89-24354
Manned interventions at the MTFF: Crew workload

p 206 N89-24362 Medical and radiation protection problems in space p 199 N89-24369

EVA Information System: A modern workstation in pace p 206 N89-24388 Crew training aspects p 202 N89-24396

INDIA

Oxygen, ozone, aerosols and ultraviolet extinction in p 191 A89-41017 geological times Proterozoic microfossils from manganese orebody, p 192 A89-41860 ITALY

Advanced MMI and image handling to support crew ctivities p 206 N89-24392 activities

JAPAN

Resolved motion rate control of space manipulators with p 203 A89-42808 generalized Jacobian matrix

NETHERLANDS

p 204 A89-43074 The Hermes Robot Arm Direct manipulation and other styles of man-machine interaction [PB89-146070] p 204 N89-24043

p 206 N89-24387 Getting ready for EVA NORWAY

Evoked potential and other CNS reactions during a heliox dive to 360 msw p 195 A89-42154

S

SWITZERLAND

Coagulation and fibrinolysis in acute mountain sickness and beginning pulmonary edema p 194 A89-40851

U.S.S.R.

Spectral analysis of vestibular nystagmus

A89-40499 Variation of cytoplasmic RNA in the rat's motor cortex neurons and caudate nuclei due to hypokinesia

p 192 A89-42405

Testing for irregularities of the cardiac rhythm and conduction in flight personnel by means of a combined functional test p 196 A89-42439 The value of polarographic measurements of

tissue-oxygen pressure in evaluating functional state of p 196 A89-42440 seamen p 204 A89-43024 Space coloristics

UNITED KINGDOM

Space robotics - Intra-vehicular operations

p 203 A89-41457 Cabin staff's perception of the impact of flying on their p 200 A89-43323 physical health

Fit to fly? Some common problems in otolaryngology p 196 A89-43324 Medical support for manned spaceflight

p 197 A89-43325

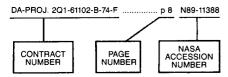
D-1

CONTRACT NUMBER INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 328)

October 1989

Typical Contract Number Index Listing



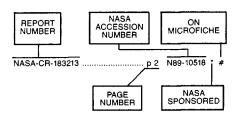
Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under the contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

DA PROJ. 3E1-62787-A-879 p 198 N89-24031 DA PROJ. 3M1-61102-BS-10 p 197 N89-24028 p 203 N89-24791 DAMD17-85-C-5206 p 195 A89-40852 p 195 A89-40852 p 195 A89-40852 p 195 A89-40852 p 195 A89-40853 p 195 A89-40852 p 195 A89-40852 p 195 A89-40852 p 195 A89-40853 p 195 A89-40852 p 195 A89-24028 p 196 A89-24028 p 197 N89-24028 p 198 N89-24032 p 198 N89-24044 p 198 N89-2			
DA PROJ. 3M1-61102-BS-15 p 199 N89-24786 p 203 N89-24786 p 195 A89-40852 p 197 N89-24786 p 197 N89-24028 p 197 N89-24028 p 197 N89-24038 p 197 N89-24038 p 198 N89-24044 p 198 N89-24048 p 198 N89-24048 p 198 N89-24048 p 199	DA PROJ. 3E1-62787-A-879	p 198	N89-24031
DAMD17-85-C-5206 p 195 A89-40852 p 195 A89-40852 D AMD17-86-C-6172 p 199 N89-24786 D AMD17-86-C-6194 p 197 N89-24028 N 89-24031 F 19628-85-C-0003 p 205 N89-24031 F 19628-85-C-0003 p 205 N89-24031 F 19628-85-C-0003 p 201 N89-24038 M 1962-86-C-0009 p 201 N89-24038 M 1962-86-C-0013 p 205 N89-24038 M 1962-86-C-0413 p 205 N89-24048 N 1962-112 p 195 A89-42158 N 1962-112 p 195 A89-42158 N 1962-112 p 195 N 1962-24048 N 1962-112 p 197 N 1962-24048 N 1962-112 p 206 N 1962-24794 N 1962-112 p 206 N 1962-24795 N 1962-112 p 1962-112	DA PROJ. 3M1-61102-BS-10	p 197	N89-24028
DAMD17-85-C-5206 p 195 A89-40852 p 195 A89-40852 p 195 A89-40852 p 195 A89-40853 p 195 A89-40853 p 195 A89-40853 p 195 A89-40853 p 195 A89-24766 A89-24028 p 197 A89-24032 p 197 A89-24033 p 197 A89-24034 p 197 A89-24034 p 197 A89-24034 p 197 A89-24034 p 197	DA PROJ. 3M1-61102-BS-15	p 199	N89-24786
DAMD17-86-C-6172 p 195 A89-40853 p 199 N89-24786 p 199 N89-24786 p 197 N89-24786 p 197 N89-24786 p 197 N89-24788 p 198 N89-24031 p 198 N89-24032 p 208 N89-24032 p 201 N89-24033 p 205 N89-24048 p 198 N89-24032 p 198 N89-24032 p 198 N89-24032 p 198 N89-24033 p 198 N89-24032 p 198 N89-24032 p 198 N89-24032 p 198 N89-24033 p 198 N89-24032 p 198 N89-24032 p 198 N89-24032 p 198 N89-24033 p 198 N89-24032 p 198 N89-24032 p 198 N89-24032 p 198 N89-24033 p 198 N89-24033 p 198 N89-24034 p 198 N89-24044 p 198 N89-240		p 203	N89-24791
DAMD17-86-C-6172 p 199 N89-24786 DAMD17-86-C-6194 p 197 N89-24028 DAMD17-87-C-7202 p 198 N89-24031 F19628-85-C-0003 p 205 N89-24032 F19628-85-C-0009 p 201 N89-24032 F33615-84-C-0600 p 198 N89-24038 F49620-86-C-0099 p 201 N89-24038 MDA903-86-C-0413 p 205 N89-24038 NASA TASK 199-21-12 p 195 A89-42156 NASW-4071 p 206 N89-24792 NASY-3482 p 197 N89-24792 NASI-18019 p 207 N89-24792 NASI-18028 p 200 N89-24793 NASB-36638 p 206 N89-24793 NCC2-327 p 203 A89-24153 NGT-21-002-080 p 192 N89-24015 NIH-ES-07086 p 195 A89-42155 NIH-MM-17129 p 191 A89-42155 NIH-MM-17129 p 191 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 </th <td>DAMD17-85-C-5206</td> <td>p 195</td> <td>A89-40852</td>	DAMD17-85-C-5206	p 195	A89-40852
DAMD17-86-C-6172 p 199 N89-24786 DAMD17-86-C-6194 p 197 N89-24028 DAMD17-87-C-7202 p 198 N89-24031 F19628-85-C-0003 p 205 N89-24032 F19628-85-C-0009 p 201 N89-24032 F33615-84-C-0600 p 198 N89-24038 F49620-86-C-0099 p 201 N89-24038 MDA903-86-C-0413 p 205 N89-24038 NASA TASK 199-21-12 p 195 A89-42156 NASW-4071 p 206 N89-24792 NASY-3482 p 197 N89-24792 NASI-18019 p 207 N89-24792 NASI-18028 p 200 N89-24793 NASB-36638 p 206 N89-24793 NCC2-327 p 203 A89-24153 NGT-21-002-080 p 192 N89-24015 NIH-ES-07086 p 195 A89-42155 NIH-MM-17129 p 191 A89-42155 NIH-MM-17129 p 191 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 </th <td></td> <td>p 195</td> <td>A89-40853</td>		p 195	A89-40853
DAMD17-87-C-7202 p 198 N89-24031 F19628-85-C-0003 p 205 N89-24032 F19628-85-C-0003 p 201 N89-24032 F33615-84-C-0600 p 198 N89-24032 F49620-86-C-0099 p 201 N89-24038 MDA903-86-C-0413 p 205 N89-24048 NASA TASK 199-21-12 p 195 A89-42156 NASA TASK 199-21-12 p 197 N89-24024 NASW-3482 p 197 N89-24792 NASW-3482 p 206 N89-24793 NAS1-18019 p 206 N89-24793 NAS1-18028 p 200 N89-24793 NAS1-18028 p 206 N89-24793 NCC2-327 p 203 A89-24795 NCC2-327 p 203 A89-24155 NIH-ES-00354-17 p 195 A89-42155 NIH-GM-17129 p 191 A89-40872 NIH-GM-17129 p 191 A89-40872 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40872 NO0014-80-C-0114 </th <td>DAMD17-86-C-6172</td> <td>p 199</td> <td>N89-24786</td>	DAMD17-86-C-6172	p 199	N89-24786
F19628-85-C-0003 p 205 N89-24049 F33615-84-C-0600 p 198 N89-24038 F49620-86-C-0099 p 201 N89-24038 MDA903-86-C-0413 p 205 N89-24048 NASG 118 p 195 A89-42156 NASA TASK 199-21-12 p 195 A89-42152 NASW-3482 p 197 N89-24024 NASW-4071 p 206 N89-24792 NASI-18019 p 207 N89-24793 NAS1-18028 p 200 N89-24793 NAS-36638 p 206 N89-24793 NCC-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24015 NIH-ES-07086 p 195 A89-42155 NIH-GM-17129 p 191 A89-40852 NIH-HL-17731 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NO0014-80-C-0114 p 201 N89-24041 N00014-87-K-0482 p 202 N89-24042 N00014-87-K-0482	DAMD17-86-C-6194	p 197	N89-24028
F33615-84-C-0600 p 198 N89-24032 F49620-86-C-0099 p 201 N89-24038 MDA903-86-C-0413 p 205 N89-24048 NAG9-118 p 195 A89-42156 NASA TASK 199-21-12 p 195 A89-42152 NASW-3482 p 197 N89-24792 NASW-4071 p 206 N89-24792 NAS1-18019 p 207 N89-24792 NAS1-18028 p 200 N89-24793 NASB-36638 p 206 N89-24793 NCC2-327 p 203 A89-42153 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-HL-14985 p 195 A89-42155 NIH-HL-14985 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NSF DMB-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0482 p 204 N89-24788 N00014-87-K-0482 p 204 N89-24082 RR04206	DAMD17-87-C-7202	p 198	N89-24031
F49620-86-C-0099 p 201 N89-24038 MDA903-86-C-0413 p 205 N89-24048 NAG9-118 p 195 A89-42152 NASA TASK 199-21-12 p 197 N89-24024 NASW-3482 p 197 N89-24792 NASW-4071 p 206 N89-24792 NAS1-18019 p 200 N89-24793 NAS1-18019 p 200 N89-24793 NAS1-18028 p 200 N89-24793 NASB-36638 p 206 N89-24793 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24155 NIH-ES-00354-17 p 195 A89-42155 NIH-GM-17129 p 191 A89-40872 NIH-GM-17129 p 191 A89-40872 NIH-HL-17731 p 195 A89-40852 NIH-BS-21802 p 191 A89-40852 NSF DMB-85-21802 p 191 A89-40872 N00014-80-C-0114 p 201 N89-24041 N00014-80-K-0289 p 202 N89-24042 N00014-87-K-0482 <td< th=""><td>F19628-85-C-0003</td><td>p 205</td><td>N89-24049</td></td<>	F19628-85-C-0003	p 205	N89-24049
MDA903-86-C-0413 p 205 N89-24048 NAG9-118 p 195 A89-42156 NASA TASK 199-21-12 p 195 A89-42152 NASW-3482 p 197 N89-24024 NASW-4071 p 206 N89-24792 NAS1-18019 p 207 N89-24793 NAS1-18028 p 200 N89-24793 NAS-36638 p 206 N89-24793 NGC-2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-GM-17129 p 191 A89-40872 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NO0014-80-C-0114 p 201 N89-24041 N00014-80-K-0289 p 202 N89-24041 N00014-87-K-0482 p 204 N89-24788 NM3-3-W-20 p 204 N89-24788 NBM-3-W-20 p 204 N89-24062 RR04108 p 199	F33615-84-C-0600	p 198	N89-24032
NAG9-118 p 195 A89-42156 NASA TASK 199-21-12 p 195 A89-42152 NASW-3482 p 197 N89-24024 NASW-4071 p 206 N89-24792 NAS1-18019 p 207 N89-24793 NAS1-18028 p 200 N89-24793 NASB-36638 p 206 N89-24793 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-HL-14985 p 195 A89-40852 NIH-HL-14985 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NO0014-80-C-0114 p 201 N89-24041 N00014-85-K-0124 p 202 N89-24041 N00014-87-K-0482 p 204 N89-24788 N00014-87-K-0482 p 204 N89-24042 RR04206 p 202 N89-24085 RR04206 p 202 N89-24045 RR04206 p 204	F49620-86-C-0099	p 201	N89-24038
NASA TASK 199-21-12 p 195 A89-24152 NASW-3482 p 197 N89-24024 NASW-4071 p 206 N89-24794 NAS1-18019 p 200 N89-24793 NAS1-18028 p 200 N89-24793 NAS8-36638 p 206 N89-24793 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NO0014-80-C-0114 p 201 N89-24041 N00014-85-K-0124 p 202 N89-24041 N00014-87-K-0482 p 202 N89-24044 N00014-87-K-0482 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24045 RR04209 p 204 N89-24045 RR04209 p 200	MDA903-86-C-0413	p 205	N89-24048
NASA TASK 199-21-12 p 195 A88-42152 NASW-3482 p 197 N89-24024 NASW-4071 p 206 N89-24794 NAS1-18019 p 207 N89-24793 NAS1-18028 p 200 N89-24793 NAS8-36638 p 206 N89-24793 NCC2-327 p 203 A89-42155 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NSF DMB-85-C1802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24041 N00014-85-K-0124 p 202 N89-24041 N00014-87-K-0482 p 202 N89-24044 N00014-87-K-0482 p 204 N89-24788 NM3-3-M-20 p 204 N89-24045 RR04206 p 202 N89-24045 RR04209 p 201 N89-24788 RR04209 p 200	NAG9-118	p 195	A89-42156
NASW-4071 p 206 N89-24792 p 206 N89-24792 p 207 N89-24794 NAS1-18028 p 200 N89-24033 NASB-36638 p 206 N89-24793 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24153 NIH-ES-07086 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-HL-14985 p 195 A89-42155 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NSF DMB-85-21802 p 191 A89-40852 N00014-80-C-0114 p 201 N89-24041 N00014-85-K-0124 p 202 N89-24041 N00014-87-K-0482 p 202 N89-24042 N00014-87-K-0482 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24042 RR04209 p 201 N89-24033 905-45-33-56 p 200 N89-24033 905-		p 195	A89-42152
NAS1-18019 p 206 N89-24794 NAS1-18028 p 200 N89-24793 NAS8-36638 p 206 N89-24793 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24015 NIH-ES-07086 p 195 A89-42155 NIH-GM-17129 p 191 A89-40877 NIH-HL-17731 p 195 A89-42155 NIH-HL-17731 p 195 A89-40872 NSF DMB-85-21802 p 191 A89-40877 N00014-86-K-0124 p 202 N89-24041 N00014-87-K-0172 p 199 N89-24041 N00014-87-K-0408 p 202 N89-24041 N00014-87-K-0408 p 202 N89-24042 N00014-87-K-0408 p 202 N89-24042 N00014-87-K-0408 p 202 N89-24042 N00014-87-K-0408 p 204 N89-24045 N00014-87-K-0408 p 205 N89-24045 N00014-87-K-0408 p 207 N89-24045 N00014-87-K-0408 p 208 N89-24045 N00014-87-K-0408 p 209 N89-24045 N00014-87-K-0408 p 209 N89-24045 N00014-87-K-0482 p 204 N89-24045	NASW-3482	p 197	N89-24024
NAS1-18019 p 207 N89-24797 NAS1-18028 p 200 N89-24793 NAS8-36638 p 206 N89-24795 NCC2-327 p 203 A89-24795 NGT-21-002-080 p 192 N89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-BS-007086 p 195 A89-42155 NIH-HL-14985 p 195 A89-40872 NIH-HL-147731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40872 N00014-80-C-0114 p 201 N89-24034 N00014-80-C-0114 p 201 N89-24041 N00014-80-K-0289 p 202 N89-24041 N00014-87-K-0482 p 202 N89-24042 N00014-87-K-0482 p 204 N89-24788 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24062 RR04209 p 201 N89-24033 073-36-00-00-72 p 200 N89-24798 505-67-21 p 207 <td>NASW-4071</td> <td>p 206</td> <td>N89-24792</td>	NASW-4071	p 206	N89-24792
NAS1-18028 p 200 N89-24033 NASB-36638 p 206 N89-24793 P 206 N89-24793 N89-24795 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 A89-42155 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-HI-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NSF DMB-65-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0482 p 204 N89-24042 RM3-3-M-20 p 204 N89-24045 RRO4108 p 199 N89-24788 RRO4206 p 202 N89-24042 RRO4206 p 202 N89-24033 9073-36-00-00-72 p 200 N89-24033 905-67-21 p 200 N89-24033 905-69-00-00 p 194		p 206	N89-24794
NASB-36638 p 206 N89-24793 p 206 NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 N89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-GM-17129 p 191 A89-40877 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40877 NSF DMB-85-21802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24037 N00014-87-K-0124 p 202 N89-24041 N00014-87-K-0172 p 199 N89-24042 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24037 073-36-00-00-72 p 200 N89-24037 075-3-56 p 200 N89-24033 050-67-21 p 207 N89-24093 050-67-21 p 207 N89-24093	NAS1-18019		N89-24797
NCC2-327	NAS1-18028	p 200	N89-24033
NCC2-327 p 203 A89-42153 NGT-21-002-080 p 192 A89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-GM-17129 p 191 A89-40852 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NO0014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0482 p 204 N89-24042 N00014-87-K-0482 p 204 N89-24045 RR3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-2403 RR04209 p 201 N89-2403 073-36-00-00-72 p 200 N89-2403 055-67-21 p 207 N89-2403 050-67-21 p 194 N89-24022	NAS8-36638		N89-24793
NGT-21-002-080 p 192 N89-24015 NIH-ES-00354-17 p 195 A89-42155 NIH-ES-007086 p 195 A89-42155 NIH-GM-17129 p 191 A89-40852 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24037 N00014-87-K-0124 p 202 N89-24042 N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24045 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24037 0505-67-21 p 207 N89-24790 805-19-00-01 p 194 N89-24022		p 206	N89-24795
NIH-ES-00354-17 p 195 A89-42155 NIH-ES-07086 p 195 A89-42155 NIH-GM-17129 p 191 A89-40877 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0482 p 204 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24037 073-36-00-00-72 p 200 N89-24037 075-3-356 p 200 N89-24790 505-67-21 p 207 N89-24028 805-19-00-01 p 194 N89-24022		p 203	A89-42153
NIH-ES-07086 p 195 A89-42156 NIH-GM-17129 p 191 A89-40872 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40872 N00014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RR3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24042 RR04206 p 201 N89-24033 973-36-00-00-72 p 200 N89-24030 905-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24032 505-60-00-01 p 194 N89-24022	NGT-21-002-080		N89-24015
NIH-GM-17129 p 191 A89-40877 NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0172 p 199 N89-24045 R00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24788 RR04108 p 199 N89-24788 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24037 505-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24792	NIH-ES-00354-17		A89-42155
NIH-HL-14985 p 195 A89-40852 NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40852 NO0014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24037 073-36-00-00-72 p 200 N89-24037 073-36-00-00-72 p 200 N89-24790 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022	NIH-ES-07086	p 195	A89-42155
NIH-HL-17731 p 195 A89-40852 NSF DMB-85-21802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 N00014-87-K-0172 p 199 N89-24042 N00014-87-K-0482 p 204 N89-24045 RR04108 p 199 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24042 RR04206 p 201 N89-24045 RR04206 p 201 N89-24045 RR04206 p 201 N89-24033 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24033 605-19-00-01 p 194 N89-24022			A89-40877
NSF DMB-85-21802 p 191 A89-40877 N00014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24040 N00014-86-K-0289 p 202 N89-24040 N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24045 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24798 505-67-21 p 207 N89-24798	NIH-HL-14985	p 195	A89-40852
N00014-80-C-0114 p 201 N89-24037 N00014-85-K-0124 p 202 N89-24042 N00014-86-K-0289 p 202 N89-24040 N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24037 073-36-00-00-72 p 200 N89-24037 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24032	NIH-HL-17731	p 195	A89-40852
N00014-85-K-0124 p 202 N89-24041 N00014-86-K-0289 p 202 N89-24042 p 202 N89-24042 N89-24042 N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24042 RR04209 p 201 N89-24790 7073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022	NSF DMB-85-21802		A89-40877
N00014-86-K-0289 p 202 N89-24040 p 202 N89-24042 p 202 N89-24042 p 199 N89-24788 p 204 N89-24045 p 204 N89-24046 p 204 N89-24082 p 204 N89-24082 p 204 N89-24082 p 204 N89-24082 p 204 N89-24037 p 204 N89-24032 p 204 N89-24032 p 204 N89-24790 p 204 N89-24798 p 204 N89-24798 p 204 N89-24798 p 204 N89-24022 p 204 <td>N00014-80-C-0114</td> <td></td> <td>N89-24037</td>	N00014-80-C-0114		N89-24037
N00014-87-K-0172 p 202 N89-24042 N00014-87-K-0482 p 199 N89-24788 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24037 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24928 805-19-00-01 p 194 N89-24022	N00014-85-K-0124	p 202	N89-24041
N00014-87-K-0172 p 199 N89-24788 N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24032 RR04209 p 201 N89-24033 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24033 505-67-21 p 207 N89-24928 805-19-00-01 p 194 N89-24022	N00014-86-K-0289		
N00014-87-K-0482 p 204 N89-24045 RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24788 RR04206 p 202 N89-24042 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022			
RM3-3-M-20 p 204 N89-24045 RR04108 p 199 N89-24708 RR04206 p 202 N89-24032 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022			N89-24788
RR04108 p 199 N89-24788 RR04206 p 202 N89-24042 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24790 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022	N00014-87-K-0482		N89-24045
RR04206 p 202 N89-24042 RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24033 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022	RM3-3-M-20		N89-24045
RR04209 p 201 N89-24037 073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24033 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022	RR04108		
073-36-00-00-72 p 200 N89-24790 505-45-33-56 p 200 N89-24032 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022	RR04206		N89-24042
505-45-33-56 p 200 N89-24033 505-67-21 p 207 N89-24798 805-19-00-01 p 194 N89-24022			
505-67-21			
805-19-00-01 p 194 N89-24022			
p 194 N89-24023	805-19-00-01		N89-24022
		p 194	N89-24023

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 328)

October 1989

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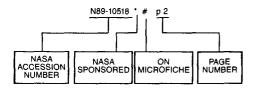


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A 00050 VOL 4	- 404		
A-88256-VOL-1	•	N89-24022	
A-88256-VOL-2	•	N89-24023	
A-89118	р 207	N89-24798	* #
AD-A204617	р 207	N89-24796	#
AD-A205331		N89-24025	#
AD-A205388		N89-24026	#
AD-A205434		N89-24045	#
AD-A205476		N89-24046	#
AD-A205668	'	N89-24034	#
AD-A205860		N89-24035	#
AD-A205861		N89-24027	#
AD-A205938		N89-24036	#
AD-A205963	` ~~.	N89-24037	#
AD-A205974	. p 197	N89-24028	#
AD-A205993	. p 201	N89-24038	#
AD-A206031		N89-24029	#
AD-A206032		N89-24030	#
AD-A206035	. p 201	N89-24039	#
AD-A206117		N89-24047	#
AD-A206141		N89-24791	#
AD-A206143	. p 199	N89-24785	#
AD-A206157	. p 202	N89-24040	#
AD-A206173	. p 202	N89-24041	#
AD-A206180	. p 199	N89-24786	#
AD-A206196	. p 199	N89-24787	#
AD-A206201		N89-24048	#
AD-A206213	. р 199	N89-24788	#
AD-A206452	. р 202	N89-24042	#
AD-A206463	. p 198	N89-24031	#
AD-A206514		N89-24032	#
AD-A206518		N89-24789	#
AD-A206574	. p 205	N89-24049	#
AFOSR-89-0361TR	. p 201	N89-24038	#
AFRRI-TR88-2	. р 197	N89-24026	#
Al-TR-1092	. p 202	N89-24041	#
AMSEL-NV-TR-0075	р 205	N89-24047	#
ARI-RN-89-04	. р 205	N89-24048	#
ARL-88-2	р 199	N89-24786	#
CMU/SEI-89-TR-4	p 205	N89-24049	#
DREO-998	p 205	N89-24046	#
ESD-TR-89-04	p 205	N89-24049	#
ETN-89-94509	p 205	N89-24050	#
GIT-88-4	p 204	N89-24045	#

IAF-88-037	p 205	N89-24050	#
MDC-K1413	p 200	N89-24033	* #
MDC-W5125-2 MDC-W5141-2-VOL-2	p 206 p 206	N89-24793 N89-24795	
NAS 1.15:100363 NAS 1.15:100474 NAS 1.15:102187 NAS 1.26:180450 NAS 1.26:181700 NAS 1.26:182495	p 200 p 207 p 192 p 200 p 206	1409-24/92	* # # # # # #
NAS 1.26:182496 NAS 1.26:183589 NAS 1.26:183590 NAS 1.26:184895	p 206 p 206 p 206 p 197	N89-24794 N89-24795 N89-24793 N89-24024	*##
NAS 1.26:4240 NAS 1.55:10026-VOL-1 NAS 1.55:10026-VOL-2	p 207 p 194 p 194	N89-24797 N89-24022 N89-24023	* #
NASA-CP-10026-VOL-1 NASA-CP-10026-VOL-2	p 194 p 194	N89-24022 1 N89-24023 1	
NASA-CR-180450 NASA-CR-181700 NASA-CR-182495 NASA-CR-182496 NASA-CR-183589 NASA-CR-183590 NASA-CR-184895	p 192 p 200 p 206 p 206 p 206 p 206 p 197	N89-24015 1 N89-24033 1 N89-24792 1 N89-24795 1 N89-24793 1 N89-24024 1	#
NASA-TM-100363	p 207 p 204	N89-24797 ¹	#
NASA-TM-100474 NASA-TM-102187	p 200 p 207	N89-24790 * N89-24798 *	* # * #
NEDU-1-89	р 197	N89-24025	#
NHRC-88-50		N89-24027	#
NPRDC-TR-89-6	•	N89-24035	#
NSMRL-1095 NTSC-TR-88-028	•	N89-24034 N89-24036	#
ONR-TR-89-2	р 202	N89-24042 N89-24037	##
	p 204	N89-24043	#
REPT-88-53	p 204 p 205	N89-24043 N89-24050	# #
S-591	p 200	N89-24790 *	#
TR-89-1	p 202	N89-24040	#
USAFSAM-TP-88-11	p 199	N89-24787	#
USAFSAM-TR-88-24	p 198	N89-24032	#
USARIEM-M17-89	p 201 p 203 p 199 p 198 p 199 p 198	N89-24039 N89-24791 N89-24785 N89-24029 N89-24789 N89-24030	#####

Typical Accession Number Index Listing



Listings in this index are arranged alphanumerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A89-40118	p 191	N89-24024 * #	p 197
A89-40124	p 191	N89-24025 #	p 197
A89-40125	p 191	N89-24026 #	p 197
A89-40498	p 194	N89-24027 #	p 197
A89-40499	p 194	N89-24028 #	p 197
A89-40811 #	p 203	N89-24029 #	p 198
A89-40825	p 194	N89-24030 #	p 198
A89-40851	p 194	N89-24031 #	p 198
A89-40852	p 195	N89-24032 #	p 198
A89-40853	p 195	N89-24033 * #	p 200
A89-40877	p 191	N89-24034 #	p 200
A89-40924	p 191	N89-24035 #	p 201
A89-40971	p 191	N89-24036 #	p 201
A89-41017	p 191	N89-24037 #	p 201
A89-41113	p 192	N89-24038 #	p 201
A89-41457	p 203	N89-24039 #	p 201
A89-41619	p 192	N89-24040 #	p 202
A89-41851	p 192	N89-24041 #	p 202
A89-41860	p 192	N89-24042 #	p 202
A89-42152 *	p 195	N89-24043 #	p 204
A89-42153 *	p 203	N89-24044 *#	p 204
A89-42154	p 195	N89-24045 #	p 204
A89-42155	p 195	N89-24046 #	p 205
A89-42156 *	p 195	N89-24047 #	p 205
A89-42157	p 196	N89-24048 #	p 205
A89-42158	p 196	N89-24049 #	p 205
A89-42159	p 196	N89-24050 #	p 205
A89-42160	p 200	N89-24354 #	p 205
A89-42162	p 200	N89-24362 #	p 206
A89-42163	p 200	N89-24369 #	p 199
A89-42405	p 192	N89-24374 #	p 202
A89-42439	p 196	N89-24375 #	p 202
A89-42440	p 196	N89-24387 #	p 206
A89-42728	p 203	N89-24388 #	p 206
A89-42808	p 203	N89-24392 #	p 206
A89-43024	p 204	N89-24396 #	p 202
A89-43074 #	p 204	N89-24785 #	p 199
A89-43119 #	p 192	N89-24786 #	p 199
A89-43141	p 204	N89-24787 #	p 199
A89-43322	p 196	N89-24788 #	p 199
A89-43323	p 200	N89-24789 #	p 199
A89-43324	p 196	N89-24790 * #	p 200
A89-43325	p 197	N89-24791 #	p 203
A89-43425	p 207	N89-24792 * #	p 206
A89-43640	p 197	N89-24793 * #	p 206
		N89-24794 * #	p 206
N89-23904 * #	p 204	N89-24795 * #	p 206
N89-24015 *#	p 192	N89-24796 #	p 207
N89-24016 * #	p 193	N89-24797 * #	p 207
N89-24017 *#	p 193	N89-24798 * #	p 207
N89-24018 * #	p 193		
N89-24020 * #	p 193		
N89-24021 *#	p 193		
· · - · · · · · · · · · · · · · · ·	•		
N89-24022 * #	p 194		

N89-24023 *# p 194

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Title and Subtitle Aerospace Medicine and Biology			5. Report Date October 1989		
A Continuing Bibliography (Supplement 328)			6. Performing Organiza	ition Code	
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Performing Organization Name and Address			10. Work Unit No.		
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15. Supplementary Notes					
				=1	
This bibliography lists 104 reports, and technical information system in S		ments introduced into	the NASA scientif	ic	
	•				
17. Key Words (Suggested by Authors(s)) Aerospace Medicine Bibliographies Biological Effects	1	18. Distribution Statement Unclassified - Unlin	nited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of t Unclassified	this page)	21. No. of Pages 52	22. Price * A04/HC	